THE NASSER D. KHALILI COLLECTION
OF ISLAMIC ART

SCIENCE, TOOLS & MAGIC

FRANCIS MADDISON & EMILIE SAVAGE-SMITH

THE NOUR FOUNDATION

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THE NASSER D. KHALILI COLLECTION OF ISLAMIC ART

VOLUME XII

Part One

General Editor Julian Raby

The Nour Foundation
in association with
Azimuth Editions and Oxford University Press

SCIENCE, TOOLS & MAGIC

Part One. Body and Spirit, Mapping the Universe

by Francis Maddison
and Emilie Savage-Smith

Published in the United Kingdom
by The Nour Foundation
in association with Azimuth Editions
and Oxford University Press

The Nour Foundation is part of The Khalili Family Trust

The Nour Foundation
Nour House, 6 Hill Street, London W1X 7FU, England

Azimuth Editions
33 Ladbroke Grove, London W11 3AY, England
Edited by Julian Raby and Alison Effeny
Design by Anikst Associates

Oxford University Press, Walton Street, Oxford OX2 6DP

Oxford New York
Athens Auckland Bangkok
Bombay Calcutta Cape Town Dar es Salaam Delhi
Florence Hong Kong Istanbul Karachi Kuala Lumpur
Madras Madrid Melbourne Mexico City
Nairobi Paris Singapore Taipei Tokyo Toronto
and associated companies in
Berlin Ibadan

Oxford is a trade mark of Oxford University Press

Published in the United States
by The Nour Foundation
in association with Azimuth Editions
and Oxford University Press Inc., New York

British Library Cataloguing in Publication Data
Maddison, Francis
Science, tools & magic. – (The Nasser D. Khalili Collection
of Islamic Art; v.12)
1. Art, Islamic
I. Title II. Savage-Smith, Emilie III. Nour Foundation IV. Nasser D.
Khalili Collection of Islamic Art V. Body and spirit VI. Mundane worlds
704. 2'971
ISBN 0–19–727610–5

Library of Congress Cataloging in Publication Data
(data applied for)
ISBN 0–19–727610–5

Photography by Christopher Phillips

Typeset by Azimuth Editions
Printed on acid-free paper by PJ Reproductions, London

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Foreword

The Nasser D. Khalili Collection of Islamic Art documents the artistic achievements of the Islamic world, but the items it contains also serve to illustrate the high level attained by Muslim society in other spheres of culture. *Science, Tools & Magic* brings together objects that relate to several aspects of that wider culture. One such aspect is scientific endeavour in fields as diverse as medicine and astronomy. The second is the techniques employed in a variety of economic activities, from beekeeping to leatherworking. The third is the invocation of supernatural forces on behalf of the individual believer, through astrology, making talismans, casting lots and other magical crafts.

The links between these three subjects are manifold. Talismanic designs were used, for example, to protect beehives, as in the case of cat.204 and 205, while in cat.135, a marble template for the mater of an astrolabe, the Collection possesses a tool that was used in the production of scientific instruments. Connections also exist at a deeper level, for the conception of knowledge and craft current in the pre-modern Islamic world was not so neatly divided into categories as is the practice today. Thus a celestial globe could be employed to tell the time, a 'scientific' use, and to cast a horoscope, an activity that is no longer counted as part of science. The single most important factor binding these elements together was a belief in Islam, but this factor has often been underestimated by the modern world, especially in relation to Islamic science.

It is generally appreciated that medieval Arab civilization preserved and enhanced the astronomical knowledge current in the Mediterranean world in the Hellenistic and Roman periods, and that the transmission of this knowledge to Christian Europe marked an important stage in the rebirth of European scientific culture. But however useful Arab astronomy may have been to the development of Europe, it was of far greater importance to the functioning of Islamic society, whose preoccupations it reflected. For the knowledge in question was fostered by the Arabs and by other Muslims for reasons of their own, some of which were intimately connected to their religious beliefs. A select few were concerned with philosophical enquiry; a larger number had recourse to astrology; but every Muslim needed to know in which direction Mecca lay, and the precise times of the five daily prayers, data that could be obtained by observing the heavens. Indeed, the well-developed match between Islamic astronomy and the everyday concerns of pious Muslims explains why this form of the science continued to flourish in lands with a Muslim population long after European scientists such as Copernicus, Galileo and Newton had led European astronomy on to a different plane of enquiry.

Emilie Savage-Smith and Francis Maddison have, I believe, made a significant contribution to the study of the themes covered by this catalogue, and I am very grateful to them for their hard work and their generosity with their time and ideas. Other people have also added their thoughts and efforts, not least Ralph Pinder-Wilson, whose work on the stone press-moulds in the Collection has illuminated a subject previously obscured by misinformation. Tim Stanley has kindly contributed a selection of locks, padlocks and tools.

Others have also made generous contributions to the project, and in particular the authors have asked me to thank, in London, Stewart Emmens of the Science Museum, Dr Sheila Canby, Dr Venetia Porter and Dr St John Simpson of the British Museum, Georgina Shirley of Sotheby's, Dr Jonathan Katz, now Master of the Queen's Scholars, Westminster School, and Regina Krahl; Dr Geoffrey Khan of the University of Cambridge; at the University of Oxford, Dr James Allan, Emeritus Professor Charles Dowsett, Miss P.M.C. Jackson, Emeritus Professor Geoffrey Lewis, Professor

Wilferd Madelung, Anthony Simcock, Andrew Topsfield and Colin Wakefield; Dr Moshe Brown of Christie's, Amsterdam; Rena and Norman Indictor in New York; Professor David A. King of Johann Wolfgang v. Goethe Universität, Frankfurt-am-Main; Daisy Raccah-Djivre of The Israel Museum, Jerusalem and Dr Raya Shani of Haifa University; Dr Sreeramula Rajeswara Sarma of Aligarh University; Dr George Scanlon of the American University in Cairo; Professor V.N. Sharma, at present at the University of Wisconsin; John Tuddenham of Preston Crowmarsh, Oxfordshire; Anthony J. Turner, Le Mesnil-le-Roi, France; Madge and Roderick Webster of the Adler Planetarium, Chicago; Mohamed Zakariya of Alexandria, Virginia; and Dr M.B. Smith and Patricia Maddison in Oxford.

For my own part, I should like to acknowledge the contribution of Christopher Phillips for his photography, and Diane Dixson-O'Carroll, who provided all the drawings. At Azimuth Editions, Julian Raby and Alison Effeny edited the text and Lorna Raby supervised the production of the volumes; Anikst Associates were the designers. Wendy Keelan and Sally Chancellor provided invaluable administrative help. Most especially, the authors and I would like to thank Manijeh Bayani, Tim Stanley and Nahla Nassar, the assistant curator of the Khalili Collection, for their untiring assistance with all aspects of the project.

Nasser D. Khalili
London, 1997

Introduction

Cat.29, detail showing the figure of Mercury

The artefacts and manuscripts catalogued in this volume represent a blend of the rational, the magical and the practical – a comingling often incomprehensible to modern readers. Yet in the medieval Islamic world, the word *'ilm*, usually translated as 'science', was used for all attempts to comprehend and, to the extent that God permits, to predict and control the forces surrounding human existence. To this end, all avenues of investigation and explanation were utilized. Though such hypotheses may be largely rejected today, to many medieval thinkers magic was another form of rationality, just as astrology and alchemy were logical systems of explanation.

Astrology in some form was associated with nearly every other discipline discussed in this volume. It played a role in medical prognosis and the timing of therapy; it was a major focus for the application of astronomical theory and related instrumentation; its theories underpinned most forms of divination; and its symbolism was an important part of the magical vocabulary and of the decorative repertoire of the artisan. A magic-medicinal bowl in the Khalili Collection, cat.29, nicely illustrates this combination of astronomy, astrology, magic, and metalworking in its anthropomorphic rendering of the planet Mercury holding an astrolabe.

Despite the fact that orientation towards Mecca and the times of prayer, which marked out the day for the entire population, are the most pervasive examples of the application of pure astronomy and astronomical instrumentation, a larger proportion of medieval and early modern society probably used divination and magic rather than the more 'rational' sciences of mathematics, astronomy or Greek humoural medicine. Divinatory techniques were used by many for the prognosis and diagnosis of mental and physical illnesses, to determine the well-being of someone who was absent or in gaol, to discover the location of lost property, or to determine the appropriateness of a proposed action. Magic-medicinal bowls and amulets represent medical care at a more popular level than the formal, learned face of medicine represented by most treatises. God's blessing and protection were sought on all occasions and by every available means, sometimes by wearing amulets, sometimes by employing magical equipment or a talismanic chart, and sometimes by placing a talismanic or benedictory inscription on a utilitarian object, such as a mortar, lock or spoon.

Dividing this diverse collection into groups of related artefacts and manuscripts has provided the opportunity to reflect in our accompanying essays upon the importance of each type of object as a remnant of the material culture. Under each topic, we have tried to combine the evidence provided by the artefacts themselves with that of written treatises regarding the practice of a particular art or technique. On occasion there is a discrepancy between written text and object. At other times the artefacts enrich our understanding of the text, as sometimes the literature helps us understand the surviving artefact. Throughout the volume, consideration has been given – to the extent that available evidence permits – to the historical development of each type of object.

Certain classes of objects covered in this volume, such as alchemical equipment, mortars and pestles, and magical mirrors, have received very little attention from scholars. In the case of other objects (the so-called cupping glasses and the curious sphero-conical vessels, for example), their very function is still a matter of speculation. For scientific and magical material in general, there is in most instances no unequivocal association of objects with reliably dated sites. The signed astronomical instruments are a refreshing exception to this limitation, and it is possibly for this reason that they have been the subject of greater historical study than any other topic covered here. In a few

instances the makers of astronomical instruments are known to have made other metal objects, yet little is known about the relationships, if any, between the workshops that produced scientific, magical and practical tools.

Under the broad title of *Science, Tools and Magic* we have gathered in this volume of the catalogue of the Khalili Collection objects that represent the everyday practices and concerns of both the educated and the illiterate, the affluent and the poor. The material has been divided into three categories, dealing with 'Body and Spirit' and 'Mapping the Universe' in Part One and 'Mundane Worlds' in Part Two. The intention has been to move beyond the standard grouping often found in studies of Islamic scientific instruments, and the limitations of so many art-historical approaches. The aim instead has been to convey a sense of the diversity of objects used in a wide variety of applications, many of which are ignored in discussions of art and culture. Some of the objects presented here are of outstanding historical importance, while others are surprisingly attractive for ostensibly utilitarian objects, and are of genuine art-historical interest. Some, though they are without great aesthetic pretensions, are published with the intention of broadening our understanding of the material culture of the Islamic world. All embody techniques and principles of design that transcend their immediate, practical use. By including objects of both medieval and more modern date, we hope to demonstrate the continuity of Islamic traditional and scientific practice well into the 20th century.

Body and Spirit

The depiction of human anatomy in the Islamic world

by Emilie Savage-Smith

Figures 1, 2
From Andreas Vesalius, *De humani corporis fabrica*, Basle 1543, Book 1, first and third skeletal figures, respectively. After Saunders & O'Malley 1950, pls 21 and 23.

Systematic human anatomical dissection was no more a pursuit of medieval Islamic society than it was of medieval Christendom. It seems clear from the available evidence, however, that there were no explicit legal or religious strictures banning it.[1] Indeed, many Muslim scholars lauded the study of anatomy, primarily as a way of demonstrating the design and wisdom of God, and there are some references in scholarly and medical writings to dissection, though to what extent these reflect actual practice it is impossible to say. What is certain is that medieval Islamic writers made two noteworthy contributions to the knowledge of anatomy. One was the result of chance observation: following the discovery of some skeletons during a famine in Egypt, the scholar and physician 'Abd al-Latif al-Baghdadi (d. 1231) was able to improve the description of the bones of the lower jaw and the sacrum. The second was the description of the movement of the blood through the pulmonary transit by the Syrian jurist and physician Ibn al-Nafis (d. 1288).[2]

Knowledge of anatomy in medieval Islam was firmly based on the anatomical writings of the Greek physician Galen, who flourished in the 2nd century AD, and who to a large extent argued from analogy with animal structures. The transmission of this knowledge was principally the result of translations made in Iraq in the 9th century AD, under the patronage of the caliph al-Ma'mun (*reg.* 813–33) and his successors. The leading figure in this development was a Nestorian Christian physician from southern Iraq, Hunayn ibn Ishaq al-'Ibadi. In the course of his life Hunayn translated into Syriac or Arabic nearly all the Greek medical writings known at that time, half of the Aristotelian writings as well as commentaries, various mathematical treatises and the Septuagint. Ten years before his death *circa* 873, he recorded that of Galen's works alone he had made 95 Syriac and 34 Arabic versions. In addition to this prodigious output of translations, Hunayn also composed his own medical treatises,[3] and cat. 1 below is a rare copy of an Arabic treatise by him on the form and function of the organs of digestion. Galen is cited repeatedly throughout the work as the main source of anatomical information.

All the subsequent Arabic medical encyclopaedias had sections on anatomy. In the *Kitāb al-Manṣūrī fī al-ṭibb* of al-Razi, for example, the discussion of anatomy occurs in the first book or *maqīyah* (see cat. 6). Such works summarized the Galenic anatomical concepts and were occasionally illustrated with schematic diagrams of the eye, the cranial sutures or the bones of the upper jaw. However, no full-page anatomical illustrations of the body are known to have been produced in the Islamic world before those that usually accompany the *Tashrīḥ-i Manṣūrī*, a treatise in Persian composed by the Shirazi physician Mansur ibn Muhammad ibn Ahmad ibn Yusuf ibn Ilyas for a Timurid ruler at the end of the 14th century. One of the earliest recorded copies of this work is cat. 2 below.

A general similarity has frequently been noted between five of the six illustrations accompanying the *Tashrīḥ-i Manṣūrī* and the sets of anatomical illustrations that appeared in Latin medical treatises as early as the 12th century. The historian Karl Sudhoff referred to these European drawings as the *Fünfbilderserie* or 'five-picture series' because they illustrated the five systems of the body (arterial, venous, osseous, nervous and muscular), though they were subsequently shown to have originally contained nine rather than five illustrations, the additional four being of individual organs.[4] The similarity between the illustrations in the Latin and Persian sets is particularly evident in the diagram of the skeleton (see cat. 2, folio 10a, for example), which in both versions is viewed from behind, with the head hyper-extended so that the face looks upward and with the palms of the hands facing towards the observer – a posture, some have noted, suggestive of a dissection table. All of the figures are in a distinctive squatting posture. The origin of this anatomical series,

4, detail

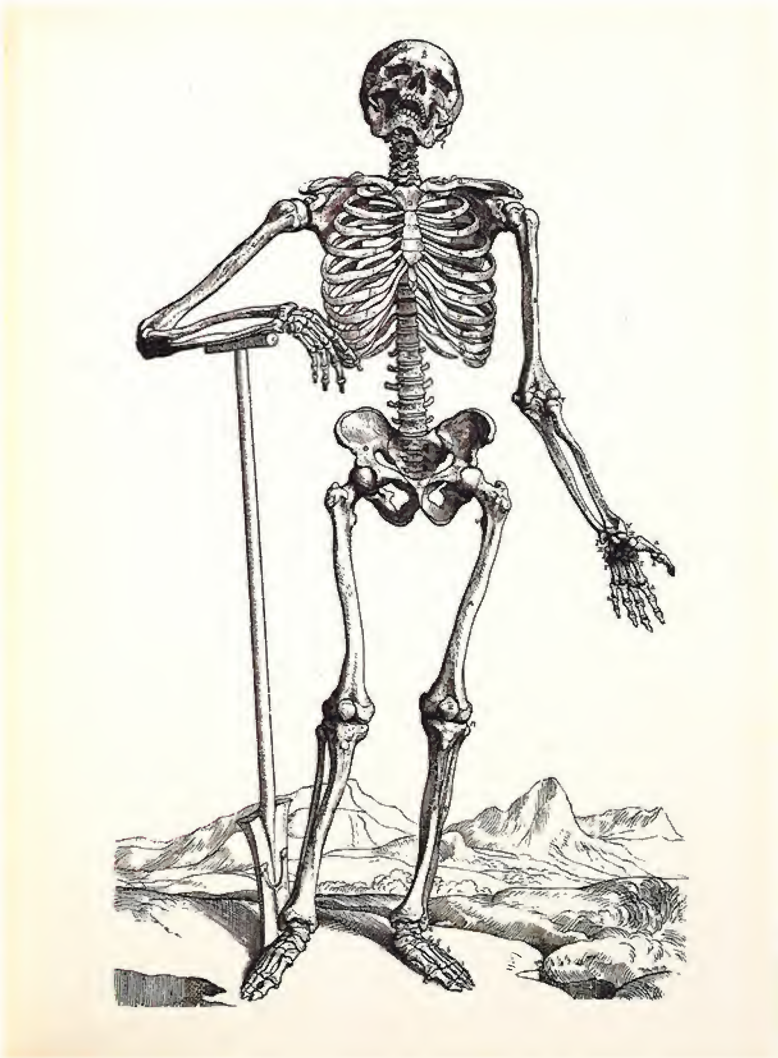


Figure 1

4, detail

Figure 2

which clearly predates the Timurid treatise by Ibn Ilyas, remains a puzzle, though the text by Ibn Ilyas and the sets of anatomical diagrams are the subject of much current research.[5]

Nearly 70 sets of these Islamic diagrams survive, of which about two-thirds are associated with the *Tashrīḥ-i Manṣūrī*. The remainder are more recent renderings, usually unlabelled, that circulated independently, as in the case of cat.3, or were inserted as illustrations into other treatises. In the Islamic tradition there is usually a sixth full-page figure showing the arterial figure on which a gravid uterus with the foetus in a breech or transverse position has been superimposed (cat.3, folio 2b). This sixth figure has no parallel in the earlier Latin series and is probably a contribution by Ibn Ilyas himself, who was particularly concerned in his treatise with Aristotelian and Galenic embryological theories and their interaction with the tradition of Prophetic medicine (on which see p.29 and cat.11 below).

While Galenic anatomy remained relatively unchallenged in the Islamic world until the 17th century, in Europe new ideas on the subject emerged from the 16th century onwards. Andreas Vesalius's Latin treatise *De humani corporis fabrica* ('On the fabric of the human body') was printed in Basle in 1543, the same year that Copernicus's *De revolutionibus orbium coelestium* ('On the revolution of the heavenly spheres') appeared, and Vesalius's work had the same transforming effect on the Western conception of the structure of the human body as Copernicus's heliocentric theory had on Western views of the Universe. While Vesalius was heir to the Humanist medical tradition that had rediscovered the classical Greek medical writings, his *Fabrica* signified a definite break with the reliance on the application, by analogy, of animal anatomy to the human body. As professor of surgery and anatomy in Padua from 1537, Vesalius had undertaken human dissections in an attempt to re-evaluate traditional Galenic anatomy, thereby founding the discipline of human gross anatomy. In the *Fabrica*, scientific innovation was combined with artistic beauty, so that the beauty and harmony of the *corpus humanum* might be made manifest.

By the 17th century Vesalius's treatise was known in the Safavid and Ottoman empires. Illustrations from the *Fabrica* clearly influenced the drawings of individual parts of the body by the Ottoman physician Shams al-Din 'Itaqi, who left his native Shirvan shortly after the Ottoman conquest in 1604. In his Turkish treatise, *Teşrîh-i ebdân ve tercümân-i kabâle-i feylesûfân*, dedicated to Sultan Murad IV in 1623, 'Itaqi intermingled rather inaccurate renderings of the Vesalian woodcuts illustrating the brain, skull, vertebral column, eye muscles, uro-genital systems and bones of the legs, feet and hands with schematic diagrams in the tradition of Ibn Ilyas.[6] Evidence of Iranian interest in Vesalian anatomy is found, for example, in an anonymous Persian manuscript of the late 17th or early 18th century, now at Yale University,[7] which contains six folios of ink sketches of individual organs based on diagrams in the *Fabrica*, while the British Library has a short Persian anatomical treatise dated AH 1108 (AD 1696–7) with an excellent ink rendering of the first full muscular figure in the *Fabrica*.[8]

It is possible that similar drawings formed the basis of a large oil painting in the Khalili Collection, cat.4, and that the artist did not work directly from a copy of the *Fabrica*. It is certain, however, that the woodcuts in Vesalius's treatise formed the basis, either directly or indirectly, for this 19th-century Qajar painting. Formal instruction in modern European medicine began in Iran only in 1850, with the establishment of a medical and military school in Tehran. The founder of this school, known as the *Dār al-Funūn* ('Academy of Sciences'), was the chief minister, Mirza Taqi Khan, who had recognized the need for such an institution during his diplomatic travels in Europe, and most of the physicians who taught at the school were brought from Italy or Austria and gave instruction in

French.[9] From extant student notes written in Persian and from Persian translations of European textbooks made at the school, we know that human anatomy formed an important part of the curriculum, and it is tempting to conjecture that the large anatomical painting was made for use in this school. If indeed this painting was used as a teaching aid, it is curious that such a device was based on the 16th-century Latin text by Vesalius rather than 19th-century treatises on human dissection and anatomy which, as we know from students' notes, were in use at that time.[10]

The four anatomical items in the Khalili Collection, cat. 1–4, span a period of a thousand years and demonstrate in a unique fashion the growth of anatomical knowledge in the Islamic world and the external influences upon it.

1. See Savage-Smith 1994.
2. Ullmann 1978, pp. 64–71.
3. For the treatises by Galen available in Arabic, see Sezgin 1970, pp. 68–149. For Hunayn ibn Ishaq, see Sezgin 1970, pp. 247–56; Ullmann 1970, pp. 115–19.
4. O'Neill 1969; 1977.
5. Newman in press, for example.
6. 'Itaqi, pls 7–18, 20, 34, 37–52; for further examples, see Russell 1992.
7. Yale University Medical School, Cushing MS.OR.13, folios 1a–6b. The National Library of Medicine, in Bethesda, MD, also has a Persian manuscript containing some versions of Vesalian illustrations (MS.P20, folios 558b–559a); see Savage-Smith 1994, p. 25.
8. British Library, MS.OR.5862, folios 2b–7b, with the illustration on folio 5a; the two other illustrations to this short treatise, one illustrating cautery, the other bloodletting, also show European influence.
9. Hummel 1971; Elgood 1951, pp. 501–3, 511–13.
10. For example, University of California, Los Angeles, Bio-Medical Library, Collection 1117, MSS 126, 129 and 142. This library has 19 manuscripts translated or compiled in Persian by students at the *Dār al-Funūn*. They were not included in the published catalogue of Persian medical manuscripts at UCLA but are described by Hossein Ziai in an unpublished catalogue available at the library.

1

A treatise on the organs of digestion by Hunayn ibn Ishaq al-ʿIbadi

Probably Iraq, 9th or 10th century

15 folios, now 18.3 × 12 cm, of a burnished, light-brown, fibrous paper with irregular laid lines; text area 15.3 × 7.8 cm, with 13 lines of an 'Eastern Kufic' hand (Déroche NS.III)
binding composite; the upper cover Egyptian or Syrian, 14th or 15th century, the lower cover probably South Arabian, 15th century
accession no. MSS 499
published Riyadh 1985, no.28

This is a rare and early copy of the second chapter (*maqālah*) of an anatomical treatise written by the Nestorian Christian physician and translator Hunayn ibn Ishaq al-ʿIbadi, who worked in Baghdad and died in AH 260 (AD 873) or AH 264 (AD 877). The title on folio 1a is given as, 'The third [*sic*] chapter of the book of Hunayn ibn Ishaq on what he had been asked regarding the organs of digestion and their regulation, and regarding purgatives'.[1] However, the text itself, which begins on folio 1b, is stated to contain the second chapter rather than the third. Hunayn ibn Ishaq is given as the author on both the title page and at the start of the treatise. The manuscript is undated, but the paper, ink and handwriting suggest a date in the 10th century AD. The calligraphy employed, which is transitional between Kufic and *naskh*, is typical of some early Islamic scripts from the 9th and 10th centuries.[2]

Only two other copies of this treatise are recorded. One was in a private collection in Aleppo in 1938,[3] but its present location is unknown. The title was given as *Kitāb fī tashrīḥ al-ālāt al-ghidhāʾ* ('Book on the anatomy of the digestive organs) and it comprised three chapters. The other copy is in a miscellany in Tabriz copied in AH 726 (AD 1326).[4] No further details on either manuscript are available.

In this copy a leaf is missing between folios 12 and 13, and the text breaks off at the bottom of folio 15b, before the end of the chapter. There are no rubrications or catchwords, but there are later marginal corrections and notes in several hands.

1, detail of title page

1. *Al-maqālah al-thālithah min kitāb … fī-mā suʾila ʿanhu min amr ālāt al-ghidhāʾ wa-tadbīrihi wa-amr al-dawāʾ al-mushil.* This title is repeated on folio 1b, where it begins correctly, *Al-maqālah al-thāniyah* ….
2. For example, the forms of the terminal *mīms*, as well as of other letters, are similar to those in a manuscript copied in AH 280 (AD 893), now in Istanbul, MS.Wali al-Din 3139; illustrated in Munajjid 1960. Many features are also found in a manuscript copied by Tuma al-Fustati in AH 288 (AD 900–1), now in Strasbourg, Bibliothèque Nationale et Universitaire, MS.4255 [arabe 150]; see Déroche *et al.* 1992, no.51.
3. Sbath 1938, p.43, no.316.
4. Tabriz, Kitabkhanah-i Milli, MS.3606, folios 26b–31b; see Danishpazuh & Afshar 1966, p.311; Sezgin 1970, p.253, no.6. The title given by Sezgin is identical to that in cat.1: Danishpazuh and Afshar give it simply as the *Ālāt al-ghidhāʾ* ('Organs of digestion') by Hunayn ibn Ishaq.

2

The *Tashrīḥ-i Manṣūrī* of Ibn Ilyas

Perhaps Shiraz, *circa* 1450

27 folios, 25.7 × 17.4 cm, of a thin, burnished, light-brown laid paper, with no visible chain lines; text area, 18.1 × 11.7 cm, ruled in black, gold and blue, and containing 21 lines in a fine *naskh* hand, written in black ink, with rubrications; folio 1a bears a medallion containing the title and two pendants, and these and the head-piece on folio 1a are illuminated in blue, gold and red; there are five full-page anatomical drawings, annotated in black and red and with some colour for contrast, on folios 10a, 14b, 16a, 20a and 22a
binding tooled brown leather covers and press-moulded doublures of a type current in Egypt and Syria in the 14th and 15th centuries
accession no. MSS 387
published Riyadh 1985, no.47

The *Tashrīḥ-i Manṣūrī* ('Mansur's Anatomy') – or *Kitāb Tashrīḥ al-badan* ('Book of the anatomy of the human body'), as it is called in the illuminated roundel on folio 1a – was composed in Persian by Mansur ibn Muhammad ibn Ahmad ibn Yusuf ibn Ilyas, who was descended from a Shirazi family of scholars and physicians. The treatise was dedicated to Ziyaʾ al-Din Amirzadah Pir Muhammad Bahadur Khan,[1] who is probably to be identified with Timur's grandson Pir Muhammad ibn ʿUmar Shaykh, governor of Fars between 1394 and 1409.[2]

This copy is undated, but a barely legible note at the bottom of folio 21b – in what is now very light ink, and therefore probably added by the same hand that wrote the set of catchwords – includes the words *sanah 907* ('the year 907', that is AD 1501–2). This indicates that the manuscript was written before the end of the 15th century, while the calligraphy, the paper and the nature of the illumination on folios 1a and 1b strongly suggest a date in the early to mid-15th century.

The illustrations and their numerous labels, as well as the illumination, are similar to those in another undated 15th-century copy of this work in the Chester Beatty Library, Dublin, although the latter was written in *taʿlīq* script rather than *naskh*.[3] Both the Khalili and Dublin manuscripts appear to predate the earliest dated copy, which was made by a scribe resident in Isfahan called Hasan ibn Ahmad Ardistani in AH 984 (AD 1488) and is now in the National Library of Medicine in Bethesda, Maryland.[4]

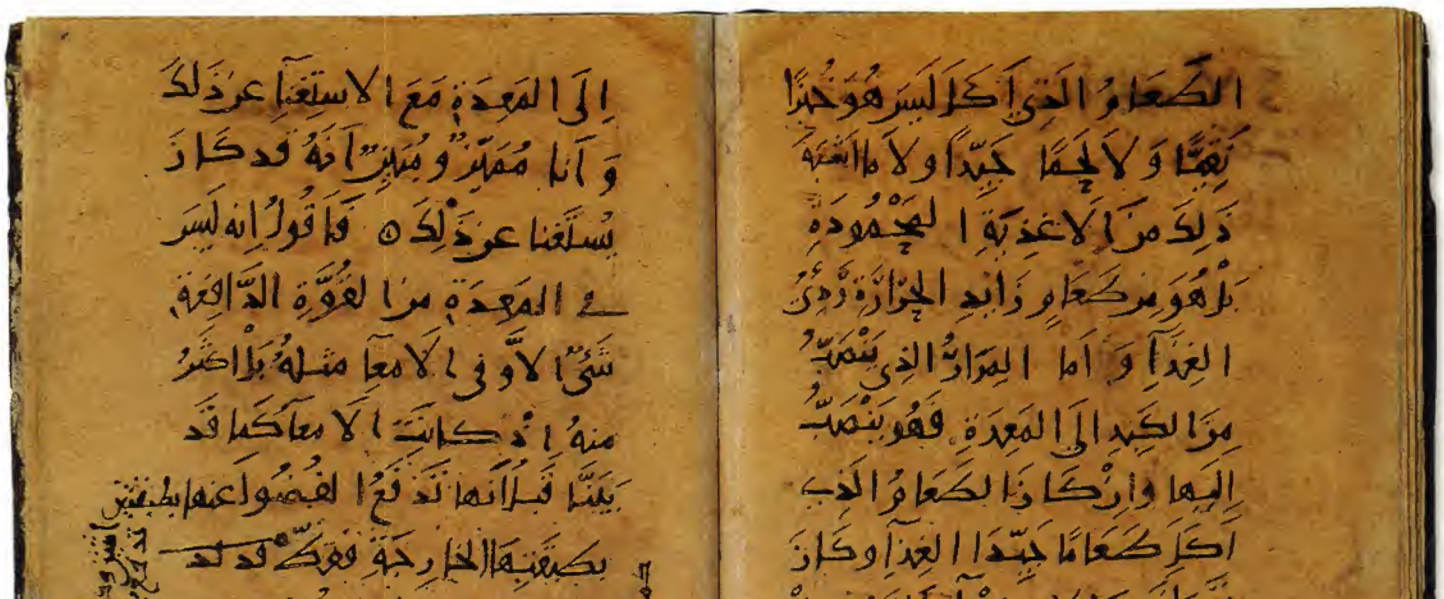
The treatise consists of an introduction (*muqaddimah*, folios 1b–5a) and five chapters (*maqālah*) on the five 'systems' of the body, that is, the skeleton (folios 5a–10a), the nerves (folios 10b–14b), the muscles (folios 15a–16a), the veins (folios 16b–20a) and the arteries (folios 20b–22a), with a final chapter (*khātimah*) on the compound organs, such as the heart and brain, and the formation of the foetus (folios 22b–27b). Each chapter is illustrated with a full-page diagram of the system under discussion, and the final chapter is usually accompanied by a diagram of a pregnant woman, although this is missing here. The five surviving illustrations form an integral part of the text, but the space they occupy on a page is larger than the text area.

The depiction of the skeleton on folio 10a is viewed from behind, with the head hyper-extended so that the mouth is at the top of the page. The full-length figure displaying the nervous system (folio 14b) is also viewed from the back with the head hyper-extended and the pairs of nerves indicated by inks of contrasting colour (green, red and black). The muscle figure on folio 16a is shown frontally, with extensive captions describing the muscles. The fourth and fifth figures (folios 20a and 22a) showing veins and arteries, are drawn frontally, with the internal organs indicated in opaque watercolour.[5]

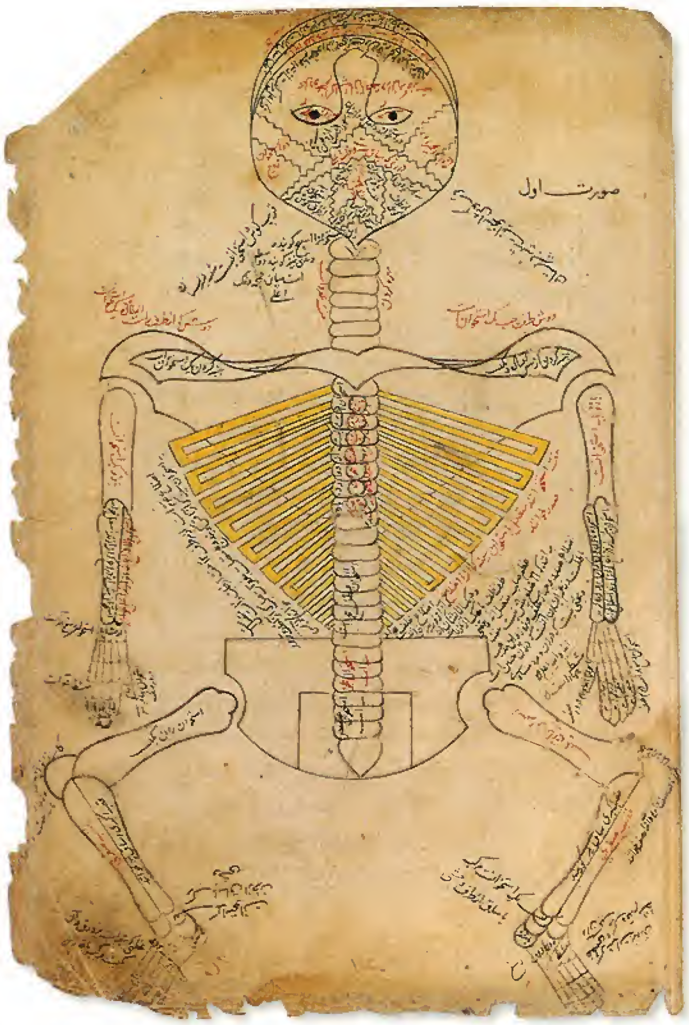
Cat.2 lacks one folio between folios 25 and 26, where the text breaks off during the discussion of the brain and resumes with a passage dealing with the reproductive organs. The text also breaks off at the bottom of folio 27b during the discussion of the membranes surrounding the foetus. The text has scribal corrections and has been collated with another copy by a later reader, in addition to other marginalia and interlinear notes.

1. See folio 2a, line 10. The name of the author is given as Mansur ibn Muhammad ibn Ahmad in lines 2–3.
2. For the identification of the patron, the life and writings of the author, and other copies of this treatise, see Richter-Bernburg 1978, pp.46–53; Keshavarz 1986, pp.340–42; Storey 1971, pp.225–7.
3. Persian MS.130. Persian MS.129 in the same library, though similar, is not as closely related either calligraphically or textually and would appear to be a later Timurid copy; Arberry, Minovi & Blochet 1959, pp.58–9.
4. Schullian & Sommer [1950], p.335; an expanded and updated catalogue of the Persian and Arabic items in this collection is currently available from the Library in an on-line catalogue prepared by Emilie Savage-Smith.
5. There are heavy indentations, caused by tracing, on the nerve figure (folio 14b), and lighter indentations on the arterial figure (folio 22a).

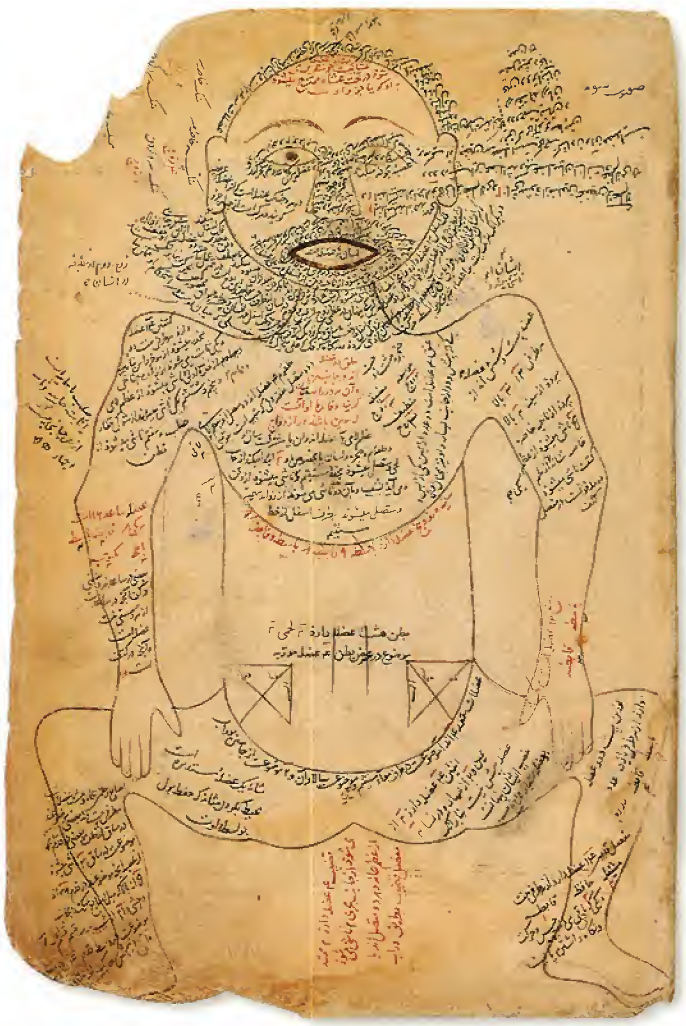
1, folios 1b–2a



1, folios 11b–12a

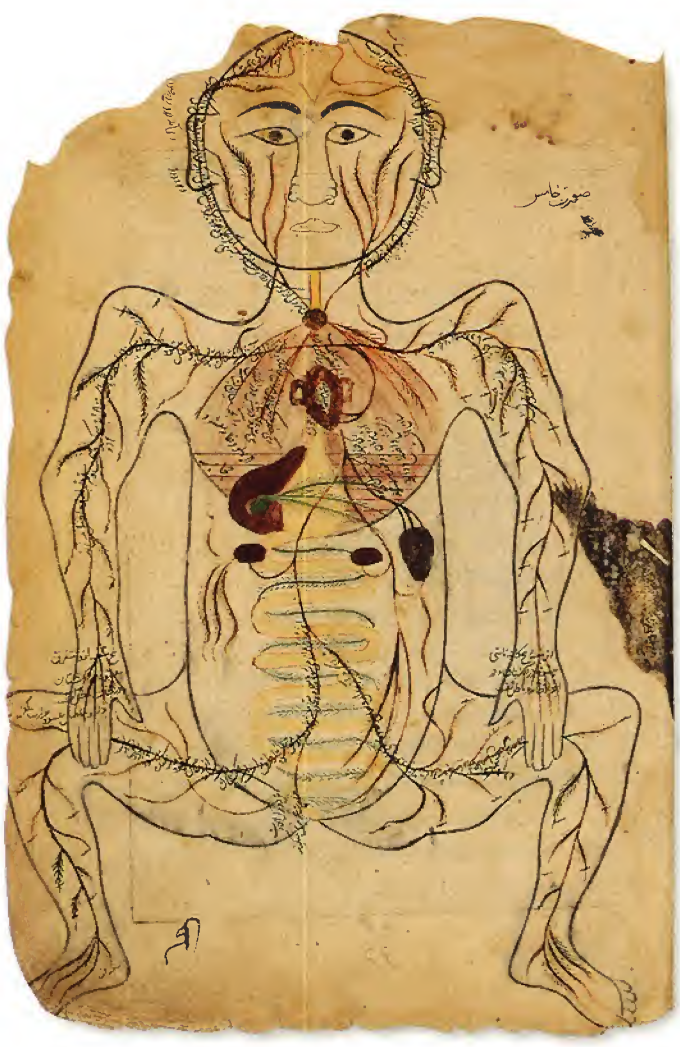


2, folio 10a

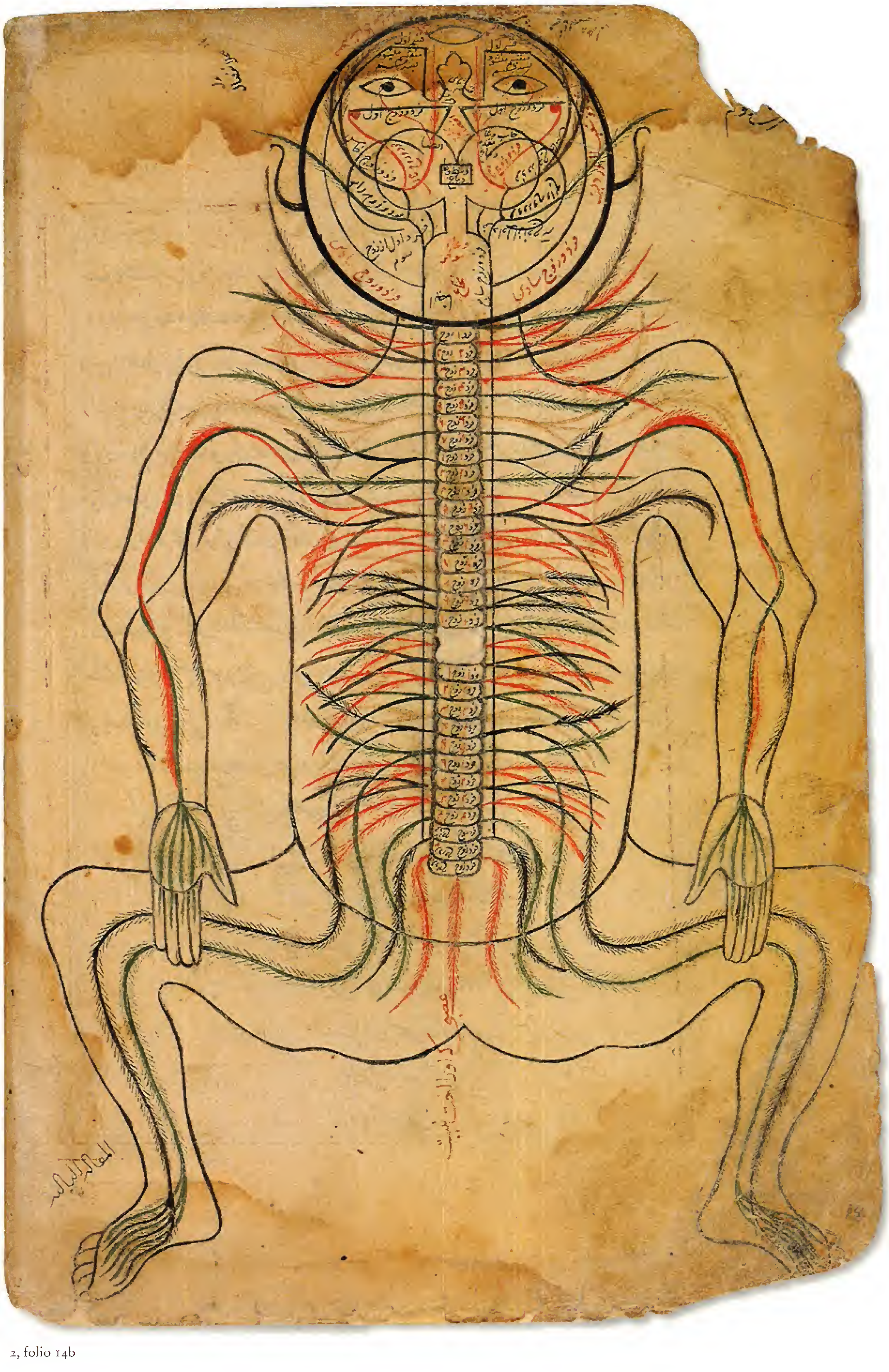


2, folio 16a

2, folio 20a

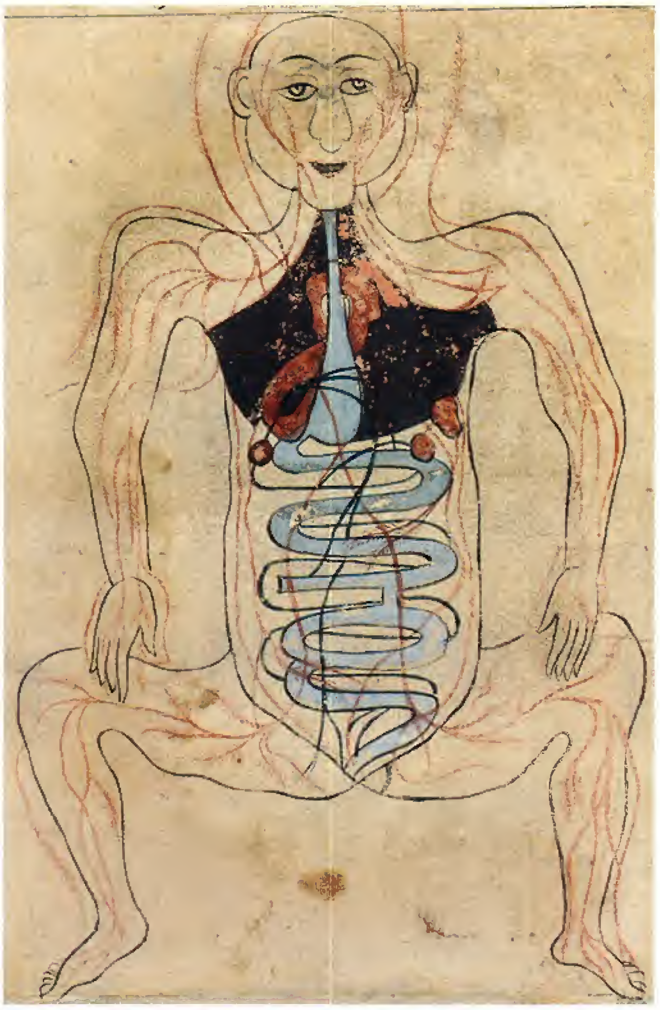


2, folio 22a

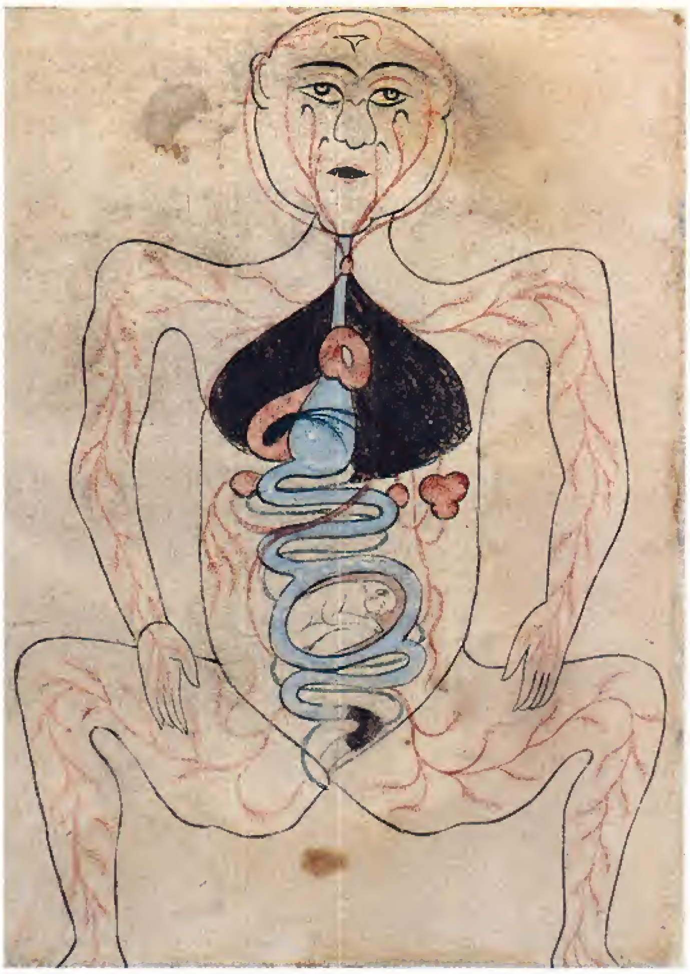


2, folio 14b

3, folio 1



3, folio 2a



3, folio 2b

3

Three anatomical drawings

Perhaps Qazvin, late 16th century

Two folios, 12.6 × 19.2 cm (MSS 454.1) and 15.4 × 20.3 cm (MSS 454.2), of a burnished laid paper with no visible chain lines; the diagrams were executed in ink and opaque watercolours within frames ruled in ink
accession no. MSS 454.1–2

The three untitled, full-page anatomical diagrams appear on two leaves. The first folio (MSS 454.1) illustrates the arterial system, while the second (MSS 454.2) shows the venous system on one side and a pregnant woman on the other. Both folios appear to be from the same set, which was based on the illustrations to the *Tashrīḥ-i Manṣūrī* of Ibn Ilyas (see cat. 2).

The fact that the woman gravid with foetus is on the other side of the leaf to the figure displaying the veins is a clear indication that these illustrations did not come from a copy of Ibn Ilyas's treatise, in which the chapter on the veins does not immediately precede the chapter on the formation of the foetus. They must instead have been prepared as an independent set. The three diagrams also differ from the illustrations in the treatise in that they lack the extensive labelling that occurs in most copies of Ibn Ilyas's work on all the figures except that showing the pregnant woman. This last is always uncaptioned and consists basically of the arterial figure with a crouching, rather mature looking, foetus inside an oval compartment in the intestines.

In contrast to the completely circular heads found in 15th- and early 16th-century anatomical illustrations, such as those in cat. 2, the slightly elongated heads and prominent chins of these three figures suggest a late 16th-century Iranian provenance, possibly Qazvin. In design and execution, the anatomical broadsheets that comprise cat. 3 most closely resemble the unlabelled illustrations that accompany an undated copy of the *Tashrīḥ-i Manṣūrī* now in Istanbul.[1]

1. Süleymaniye Library, MS. Ayasofya 3598.

4

An anatomical painting

Iran, second half of the 19th century

Oil paint on canvas, 201 × 122 cm
accession no. MSS 873
published Christie's, London, 9 October 1990, lot no. 17

This large anatomical oil painting was probably intended for teaching purposes. The painting, which is neither dated nor signed, illustrates the introduction of early modern European anatomical ideas into Iran, although these ideas are here intermingled with some medieval concepts and modified by the artistic conventions of the day. All seven full-length figures and the six individual parts of the body portrayed are based upon woodcuts in the *De humani corporis fabrica* ('On the fabric of the human body') by Andreas Vesalius, which was first published in 1543.[1]

The small skeletal figure in the centre of the painting is a rendering of the first skeletal figure in Book I of the seven books of the *Fabrica*, although here the arm rests on a simple staff rather than on the handle of a spade as in the Vesalian diagram, where the figure stands next to an open grave. Here, the left hand is rotated and the head tilted further back with the mouth closed. The skeleton immediately below is taken from the third skeletal figure in Book I, showing a posterior view of the bones, but with the head turned towards the viewer and with a rod placed under the skeleton's hands, which are unsupported in Vesalius's drawing.

The figure at the bottom left of the painting shows a frontal view of the body displaying the arrangement of the muscles. It is a mirror-image rendering of the first muscular figure in Book II of the *Fabrica*, which, Vesalius noted, would be of particular use to artists and sculptors, as well as to physicians. The figure at the bottom-right is the mirror-image of the ninth muscular figure in Book II, showing a posterior view of the superficial musculature.

The middle figure at the top, between the arms of the two large figures, is a composite interpretation of two Vesalian diagrams: the first figure in Book IV, which shows the brain and cerebellum viewed from the right side, and a mirror-image rendering of the tenth illustration in the same book, showing the course of the nerves below the neck.

The two large figures in the painting are also composite drawings taken from several Vesalian woodcuts, with some details changed. The male figure on the left displays the venous system, in general following the sixth figure in Book III of the *Fabrica* but with the posture slightly changed. Where the venous system in the neck and head were detailed in the Vesalian diagram, the artist here has painted a face with side locks in the Qajar manner, and the upper part of the skull is shown removed to reveal the brain, in a manner similar to the first figure in Book VII of the *Fabrica*. The top of the skull, showing the sutures, rests near the left foot of the male figure. The head section of the venous system is shown separately on the lower level, between the left-hand muscle figure and the skeleton leaning on a stick.

The torso of the venous figure has been altered, on the basis of the twentieth figure of Book V of the *Fabrica*, to show the abdominal cavity at the stage of dissection, where the intestines have been excised, leaving only part of the stomach. The unrealistically painted white intestines arranged in a rectilinear pattern were added to the painting at a later date. Male genitalia derived from the twenty-third figure of Book V are illustrated separately beneath the right hand.

The large female figure to the right incorporates the general scheme of the arterial system shown in the twelfth figure of Book III of the *Fabrica*, with the severed arterial head drawn separately on the lower level, between the central skeleton and the right-hand muscular figure. The torso again shows the abdominal cavity during dissection, in a manner similar to the twenty-fifth figure in Book V, but with the intestines pulled to one side rather than removed. Only the major arterial vessels are shown, both in this painting and in the original Vesalian diagrams, in contrast to the more detailed venous figure, because the importance of phlebotomy in the therapeutics of the day resulted in greater attention being paid to the arrangement of the veins. A face with a Qajar hair style has been painted on the figure, again with part of the skull removed to expose a view of the brain following further dissection, as in the second figure of Book VII of the *Fabrica*, with the base of the skull shown alongside the right foot of the figure.

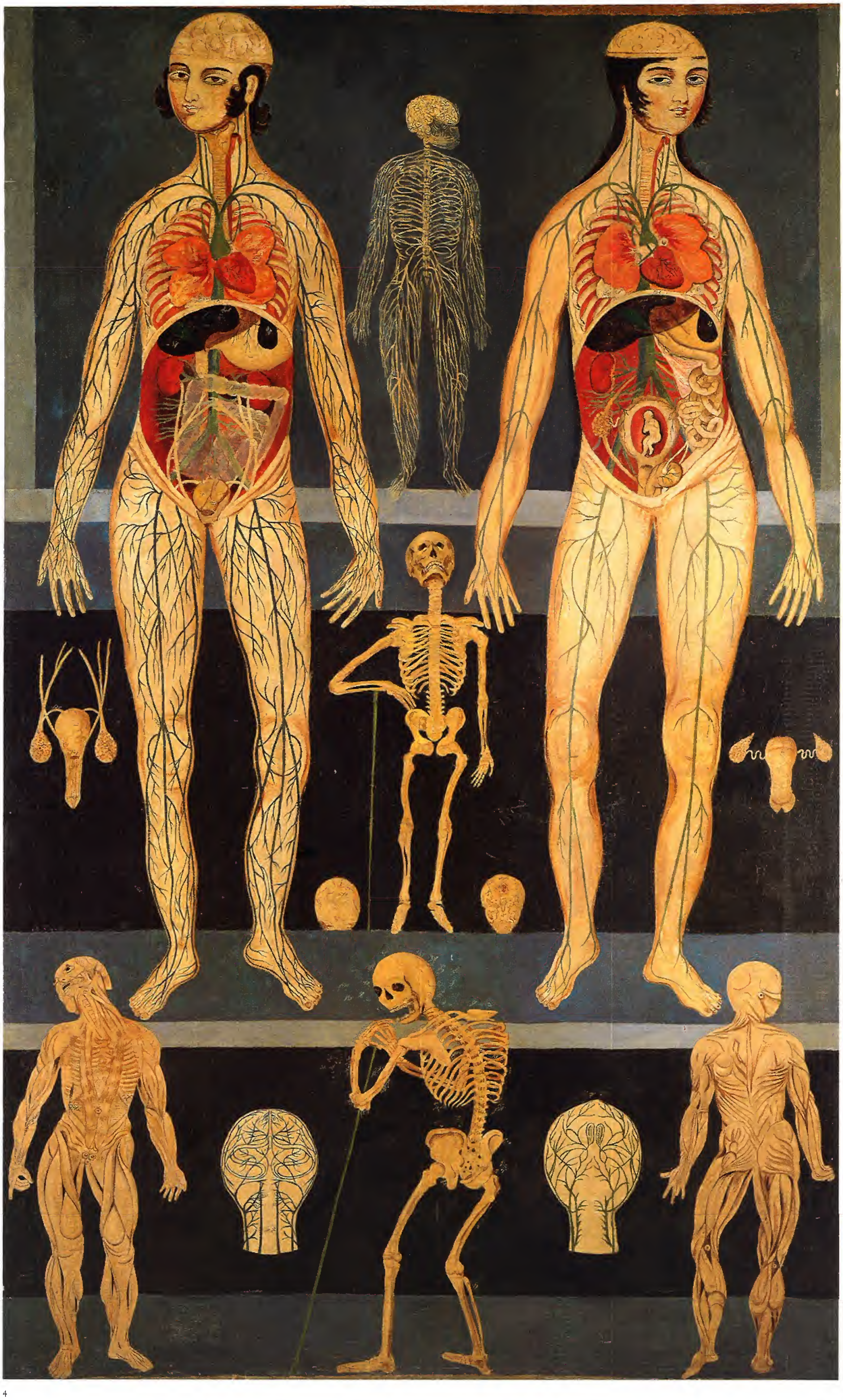
No breasts are indicated on the pregnant female figure. The foetus, shown as a miniature adult in a breech position inside an oval womb, is derived from medieval sources, such as the *Tashrīḥ-i Manṣūrī* (see cat. 2). The association of the arterial figure with that of a gravid woman is also derived from the medieval Islamic tradition of anatomical illustration.

The female genitalia are depicted separately beneath the figure's left hand. The ovaries are connected by strange spring-like connections to the womb, the depiction of which is based on the twenty-seventh figure of Book V of the *Fabrica*, where the extraordinary conformation of the organs gave rise to much comment.[2]

Many of the individual anatomical parts have labels written in a Persian *nasta'līq* hand, and beneath the severed venous and arterial heads at the bottom of the painting are several lines of text discussing the total number of bones in the body and the number of muscles. Most of the Persian captions are damaged, however, and are no longer completely legible.

While not all the details of the Vesalian diagrams are reproduced in this painting, the artist clearly followed the woodcuts closely in designing the component parts of the painting. A similar, but smaller, painting with only five figures on it was described early in this century, but its present location is unknown.[3]

1. For reproductions and discussion of all the woodcut plates in the *Fabrica*, see Saunders & O'Malley 1950.
2. See Saunders & O'Malley 1950, p. 170, for an explanation of the Vesalian diagram forming the basis of this illustration.
3. Holländer 1916, where the painting is incorrectly assigned to the late 17th or early 18th century. The present location of the painting is unknown.



Medicine in medieval Islam

by Emilie Savage-Smith

A thread of continuity within learned medical practice throughout the medieval Islamic lands was supplied, as in the case of anatomical knowledge (discussed above, pp.14–17) by the medical theories inherited from the Greek world. This heritage, mingled with some Iranian, Indian and Arab elements, was assimilated and elaborated by a community of both Muslim and non-Muslim physicians. Ninth-century Baghdad was the venue not only for the translation into Arabic of Greek medical treatises, but also for the composition of the earliest medical writings in Arabic. The following two centuries produced the most widely-read comprehensive syntheses of medical thought, including those by ʿAli ibn al-ʿAbbas, al-Majusi, al-Razi and Ibn Sina. The Khalili Collection includes a number of manuscripts illustrating various aspects of learned medieval Islamic medicine, including pharmacopoeias, general manuals on health, and a genre of medical writing composed by clerics as an alternative to medical systems based exclusively on Greek models.

The sophisticated medical texts that are the subject of this section of the catalogue, however, represent only one aspect of the medical care available within medieval Islamic society. Medical care was always multi-faceted, with the needs of the population being served by various local traditional practices as well as more formal, learned theoretical medicine. The Khalili Collection includes many examples of magic-medicinal bowls, amulets, and objects used as talismans and for divinatory purposes (see below, pp.72–105, 132–47 and 148–59, respectively). Such items were employed for the avoidance of diseases and afflictions as well as their diagnosis, prognosis and cure. Medical practice varied not only according to time and place, but also to the various social strata inhabited by the patients, whose social and economic status determined to a large extent their expectations and the type of care sought.

Materia medica

Knowledge of medicinal substances in the medieval Islamic world was based initially upon the approximately 500 materials described in the 1st century AD by Dioscorides, in his Greek treatise on materia medica. Several Arabic translations and revisions of the work of Dioscorides were undertaken, not to mention the many epitomes and commentaries. In the middle of the 9th century, in Baghdad, Istafan ibn Basil translated it into Arabic in collaboration with Hunayn ibn Ishaq. This version circulated in two forms, one in the original order determined by function,[1] and the other in an imposed alphabetical order. In the following century a new translation was prepared in Spain following the presentation of an illustrated Greek copy by the Byzantine emperor to the Spanish Umayyad ruler ʿAbd al-Rahman III, and in Iran the translation made by Istafan and Hunayn was revised by al-Natili. In the middle of the 12th century yet another translation was made in Diyar Bakr by Mihran from a Syriac version prepared earlier by Hunayn.[2]

By the end of the 13th century a number of illustrated treatises on materia medica had appeared that were original compositions in Arabic rather than translations of Dioscorides. Most of these illustrated pharmacopoeias are now lost, but one notable exception is the illustrated copy of a treatise on materia medica by the Spanish-Arab pharmacologist Abu Jaʿfar Ahmad ibn Muhammad al-Ghafiqi (d. 1165) that is today in the Osler Library at McGill University.[3] Another, partial exception is the book of medicaments compiled by the Syrian herbalist Rashid al-Din ibn al-Suri (d. 1243) and illustrated with figures taken from living plants, for large extracts from this text have recently been discovered in a unique copy of a treatise written in 1268 by a Syrian writer on antidotes.[4] Cat.5, two folios from a 12th- or 13th-century manuscript on materia medica, may also represent a relic of

10, folio 16a, detail showing a barberry plant.

this tradition of illustrated Arabic herbals, rather than a fragment of an Arabic version of the Dioscorides text itself.

Numerous Arabic and Persian treatises on medicaments were written in which Islamic authors greatly expanded the field of materia medica and its applications. They were able to do this primarily because their broader geographic horizons brought them into contact with drugs unknown to earlier peoples of the Middle East, such as camphor, musk, sal ammoniac, senna and barberry. The later treatises included the immensely popular Persian-language pharmacopoeia written in AH 770 (AD 1368–9) by Hajji Zayn al-'Attar, chief physician to the Muzaffarid ruler Shah Shuja'. Unlike the earlier compositions, however, this pharmacopoeia was rarely illustrated, and the copy in the Khalili Collection, cat. 10, which was completed in India in 1648, is one of only two recorded examples with illustrations, although well over 80 copies are known to be preserved.

General medical manuals

One of the great names in medieval Islamic medicine, Abu Bakr Muhammad ibn Zakariya' al-Razi, was born in the Iranian city of Rayy, near modern Tehran, in AD 865 and died there about 925. A physician learned in philosophy as well as music and alchemy, al-Razi served at the Samanid court in Central Asia and headed hospitals in Rayy and Baghdad. His most influential medical book was a short general textbook on medicine in ten chapters which he dedicated in 903 to the Samanid prince Abu Salih al-Mansur ibn Ishaq, governor of Rayy. The *Kitāb al-Manṣūrī fī'l-ṭibb* ('The book of medicine dedicated to al-Mansur') became one of the most widely read medieval medical manuals in Europe through the Latin translation made in Toledo by Gerard of Cremona (d. 1187). Cat. 6 is an important, though incomplete, 13th-century copy of the Arabic text.

Of all Islamic physicians, the best known name is that of Abu 'Ali al-Husayn ibn 'Abd Allah ibn Sina, known to Europe as Avicenna. He was born in AD 980 in Central Asia and travelled widely in the eastern Islamic lands, composing nearly 270 different treatises before his death in 1037. His *magnum opus* was the *Kitāb al-Qānūn fī'l-ṭibb*, or Canon of Medicine, a massive medical encyclopaedia in five books. The first is concerned with general medical principles, the second with materia medica, the third with diseases occurring in a particular part of the body, the fourth is on diseases such as fevers that are not specific to one part of the body, and the final book contains a formulary giving recipes for compound remedies. A large number of epitomes and commentaries were subsequently written on the Canon of Medicine to clarify the contents, and the first book, on general medical principles, attracted particular attention from commentators. An influential commentary on the first book of the Canon of Medicine was written by Qutb al-Din al-Shirazi (d. 1311) and dedicated to Sa'd al-Din Muhammad, vizier to an Ilkhanid ruler of Iran, apparently Muhammad Khudabandah Öljeytü, who ruled from 1304 to 1317. The commentary, entitled *al-Tuḥfah al-Sa'dīyah* ('The present to Sa'd) or *Nuzhat al-ḥukamā' wa-rawḍat al-aṭibbā'* ('The delight of the doctors and garden of the physicians'), is stated in the introduction to include abstracts from eight earlier commentaries. Cat. 8 is a fine Ilkhanid copy transcribed sometime around 1305–6, when an owner's note stamp dated AH 705 was placed on it.

The most widely read medical encyclopaedia in Persian was the *Dhakhīrah-i Khvārazmshāhī* ('Thesaurus for the ruler of Khwarazm') of Isma'il ibn Husayn al-Jurjani, the author of a number of other medical texts and the earliest medical writer in Persian to gain a wide reputation. He undertook the task of preparing this massive encyclopaedia,

Miniature apparently showing the birth of Rustam by Caesarean section. The mother lies on her bed in the foreground while the male physician lifts the newborn child (shown as an adult in miniature) from her abdomen. Neither the male physician attending the birth nor the depiction of a 'Caesarean section' reflect the actual medical practices of the day. From the 'Stephens Inju *Shāhnāmah*', a dispersed copy of Firdawsi's work made in 1352, probably in Shiraz. Khalili Collection, MSS 920.

which covers all branches of medical knowledge current in his day, in 1110, while he was at the court of Qutb al-Din Muhammad Anushtakin, who governed Khwarazm on behalf the Seljuks. Al-Jurjani supplemented the ideas contained in the Arabic medical encyclopaedia written by Ibn Sina a hundred years earlier with quotations from medical writers of the intervening century, rendering them all into Persian.[5] As a result al-Jurjani was responsible in large part for establishing a Persian scientific vocabulary. Cat.9 contains two illuminated fragments from an exceptionally fine copy of this Persian-language encyclopaedia.

In medieval Islamic medical encyclopaedias, the approach to surgery was a conservative one. Cauterization was preferred to the use of the knife, which was resorted to only when all else failed, and major or invasive surgery was scarcely ever attempted. One might be misled by a number of illustrations in Islamic manuscripts depicting births by abdominal deliveries to think that Caesarean sections were performed by medieval Islamic surgeons.[6] Certainly they were not performed on a living woman for the delivery of a foetus, for such an effort would have resulted in the certain death of the woman, and there is no mention in the surgical literature of such a procedure ever being attempted, even as a *post-mortem* effort to save the foetus after the mother had died. Illustrations of the birth of the mythical hero Rustam in a number of manuscript copies of the *Shāhnāmah* ('Book of kings') of Firdawsi have also suggested to the casual observer that such operations might have been performed (see above). In the course of the poem, written at the end of the 10th century, it is suggested that the mother was given a drug to stupefy her and that she recovered fully from the operation. The illustrations are highly inaccurate anatomically and are intended merely as illustrations of a legend attributing a miraculous birth to its hero, a common attribute of great men in antiquity. They are not to be interpreted as reflecting contemporaneous medical practices.[7]

Miniature painting of *The birth of Rustam*, from a copy of the *Shāhnāmah* of Firdawsi made in the early 1790s in India, probably at the Mughal court.
Khalili Collection, MSS 145, folio 75a

Prophetic medicine

In addition to the Greek-based medical systems advocated by physicians such as al-Razi and Ibn Sina, there was also an alternative genre of medical writing called *al-ṭibb al-nabawī* or 'Prophetic medicine'. The authors were clerics rather than physicians, and they advocated the traditional medical practices of the Prophet Muhammad's day and those mentioned in the Qur'an in preference to the medical ideas assimilated from Hellenistic society, thereby producing a guide to medical therapy that was acceptable to the religiously orthodox.[8] The therapy recommended in these treatises included diet and simple drugs, especially honey, bloodletting and cautery, but no surgery. Other topics included fevers, leprosy, plague, poisonous bites, protection from night-flying insects, protection against the evil eye, rules of coitus, theories of embryology and anatomy, the proper conduct of physicians, and the treatment of minor illnesses such as headaches, nosebleeds, coughs, colic and sciatica. There was a prohibition against the use of wine and soporific drugs as medicaments. The treatises also provided numerous prayers and pious invocations to be used by the devout patient, with designs for the occasional amulet and talisman. Treatises on prophetic medicine were particularly popular in the 13th to the 15th century, with some still available today in modern printings. In cat.11 the Khalili Collection possesses a copy of one such work made for Sultan Süleyman the Magnificent. This manuscript contains the treatise written by the Hanbali theologian Ibn Qayyim al-Jawziyah (d.1350), which was one of the most enduring expositions of the subject.

1. See Riddle 1985 for an analysis of the plan underlying the original text by Dioscorides.
2. For these different versions, see Ullman 1970, pp.258–62; Dubler 1953–7; Sadek 1983.
3. Montreal, McGill University, Osler Library of the History of Medicine, Osler MS.7508, which has 367 coloured illustrations, was drawn in Iraq before AH 641 (AD 1256); see Gacek 1991, no.102, and fig.30. Some illustrations from the manuscript are reproduced in Brandenburg 1984, pp. 47 and 49. On al-Ghafiqi, see Dietrich 1982.
4. Bethesda, MD, National Library of Medicine, MS.a64. For Ibn al-Suri, see Ullmann 1970, pp.278, 280.
5. See Richter-Bernburg 1978, p.3, for the authorities al-Jurjani cited, and pp.3–8 for his life and writings. For additional information on other copies, see Keshavarz 1986, no.43, pp.149–54; Storey 1971, no.361, pp.207–11.
6. The illustration of the birth of Julius Caesar by 'Caesarean section' contained in a copy of a historical work in Arabic by Abu'l-Rayhan al-Biruni (d.1048) completed in AH 707 (AD 1307) has been frequently reproduced (University of Edinburgh Library, MS.or.16, folio 6b; see, for example, Ullmann 1978, opposite p.34). Over the miniature there is written in Arabic the statement, 'The reason for this was that his mother died in labour while she was pregnant with him; so her abdomen was opened, and he was taken out.' Since Julius Caesar's mother, Aurelia, outlived him, there has been some confusion of historical details by al-Biruni.
7. For a history of the Caesarean section, see Trolle 1982, especially pp.1–12; Ackerknecht 1971, pp.1034; and Haddad 1993.
8. For this type of medical literature see Dols 1992, pp.243–60; Ullmann 1970, pp.185–9; Bürgel 1976, pp.54–61; Perho 1988.

5

Two fragmentary folios from a herbal

Probably Iraq, 13th century

The upper portion of two folios, 14.2 × 16.9 cm (MSS 852.1) and 16 × 16.5 cm (MSS 852.2), of very thin but opaque paper with no laid or chain lines; each page bears 2–5 lines of text in a clear *naskh* hand and the larger part of an illustration
accession no. MSS 852.1–2
published Grube [1972], nos 6–9

The recto of the first folio (MSS 852.1) illustrates a plant that is called *al-yanbūt* in the accompanying text and can be identified with *Pulicaria dysenterica* L. or *Pulicaria vulgaris* L.[1] The text states that *al-yanbūt* grows in moist locations and that its nature (*ṭabī'ah*) is hot; it causes urine to flow abundantly and stops irregular bleeding; and its flower, when mixed with oil and used as an ointment (*duhn*), produces perspiration. The plant is drawn with long stems bearing alternate sessile leaves and berry-shaped fruit. The illustration at the top of the facing page, now lost, has offset on to this page, and the same phenomenon may be observed on the other three preserved pages.

The verso of the same folio illustrates an unnamed plant, possibly of the sorrel family, whose root is said to be good for all fevers. Three identical plants are shown, each with a single stem with ovate sessile leaves and a raceme of flowers the same shade of dark green as the rest of the plant.

The plant illustrated on the recto of the second folio is also unnamed and unidentified. It consists of a single stalk with opposite petiole lanceolate leaves and triangular trillium-shaped burgundy-red flowers on long stems issuing near the top of the stalk. The offset of the illustration from the page that was at one time bound opposite this folio is particularly clear in this instance: it illustrated a plant with many stems and perfoliate leaves

The verso illustrates the globe thistle, with the first line of the text reading, 'it is called by the Greeks *qrūqūdīlūs*'. The plant is said to be suitable for treating splenic conditions.[2] The flower head of a thistle is immediately recognizable.

The style of plant illustration and script suggest that these fragments were part of a 13th-century Iraqi illustrated treatise on materia medica. In the medieval Islamic world knowledge of medicinal substances was based upon the illustrated treatise prepared by Dioscorides in the 1st century AD and translated into Arabic under the title *Kitāb al-ḥashā'ish*, or 'Book of plants'. A dispersed copy of Dioscorides, made in Baghdad in 1224, is well-known for its scenes illustrating the gathering and production of medicinals, and part of another illustrated copy made in the same city in 1240 is also preserved.[3] Because of the existence of these manuscripts there is a tendency to assign to Dioscorides any leaf from an illustrated herbal that appears to be a 13th-century Baghdad product. But by this date a number of original works in Arabic – that are known to have been illustrated – had been compiled on the subject (see above, pp.25–26), and the present fragments may have formed part of such a treatise.

This conjecture is supported by a number of features, for example, the nature of the discussion of the globe thistle on the verso of the second folio, which is not that found in the translation of Dioscorides made by Istafan ibn Basil and Hunayn ibn Ishaq as published by Dubler.[4] Moreover, the expression *tusammī bi'l-rūmī* ('it is called by the Greeks'), used in the first line, is not typical of the Dioscorides translations and implies that the author was not a speaker of Greek. Similarly, the content of the discussion of *al-yanbūt* on the recto of the first folio bears almost no resemblance to the text in Dioscorides,[5] and the use of the word *ṭabī'ah* was not common in the Arabic versions of Dioscorides.

1. Dietrich 1988, II, p.473, no.144.
2. The Greek name is usually transliterated in the Arabic translations of Dioscorides as *qarūqūdīlāwun*. For attempts at specific botanical identification, including *Echinops sphaerocephalus* L., *Eryngium maritimun* L. and *Carlina corymbosa* L., see Dietrich 1988, II, pp.354–5, no. 9.
3. Oxford, Bodleian Library, MS.Arab.d.138. For this and the dispersed copy, see Grube 1959; Buchthal 1942; Hoffman 1993.
4. Dubler 1953–7, II, p.244, section III, 10.
5. Dubler 1953–7, II, p.293, section III, 116.

6

The *Kitāb al-Manṣūrī fī'l-ṭibb* of al-Razi

Provenance unknown, dated Rabiʿ I 670 (October–November 1271)

112 folios, 22.5 × 15 cm, of an opaque, fibrous paper with barely visible laid lines; text area 18.8 × 12.7 cm, with 18–19 lines written in black ink, with rubrications; the script is *naskh*, with some vowelling
binding modern, but incorporating older, tooled covers
accession no. MSS 329

Abu Bakr Muhammad ibn Zakariya' al-Razi (d. *circa* AD 925) composed this short general textbook on medicine in AD 903 for Abu Salih al-Mansur ibn Ishaq, the Samanid governor of Rayy. It became one of the great classical works on the subject, both in the Islamic world and in Europe, where the treatise became widely known in the Latin translation made by Gerard of Cremona in 1175, under the title *Liber medicinalis ad Almansorem*.[1]

Al-Razi's treatise was composed in ten books (*maqālahs*), each of which was divided into a number of sections (*faṣls*). Cat.6 contains a detailed table of contents (folios 1b–7a); sections 1–22 of book I, on anatomy (folios 7a–26b); sections 4–25 of book III, on food and simple medicaments (folios 27a–45b);[2] and the whole of book VI, on the maintenance of health (folios 46a–62b), of book V, on compound remedies (folios 63a–84a), of book VI, on a regimen for travellers (folios 84b–94b), and of book VII, on surgery and the treatment of wounds (folios 95a–112b).[3] The manuscript was bound predominantly in quires of eight, which are numbered from the third quire onwards (*thālith, sādis* etc.). From this it is apparent that the end of section one, section two, and the beginning of section three filled the lost fourth and fifth quires. The author is named at the end of the sixth book (folios 94b, line 19) and in the colophon (folio 112b); the scribe is not identified. The earliest foliation is in Hebrew numerals, and there are marginal notes in Hebrew, as well as in Persian and Arabic.

1. For other copies, see Sezgin 1970, pp.281–2; Ullmann 1970, p.132.
2. Sections 4 and 25 are incomplete.
3. Folio 100 is misplaced and should be read between folios 102 and 103.

6, folios 110b–111a

7

A medical text appended to a copy of the *Kitab-i akhlāq-i Nāṣirī* of Nasir al-Din al-Tusi

Iran, dated end of Rabiʿ I 668 (27 November 1269)

154 folios, 24.5 × 16.5 cm, of a thick, burnished, yellow-brown paper with barely visible laid lines; text area 19.5 × 11.8 cm, with 19 lines of *naskh* (Tusi text) and 18 lines of another *naskh* hand (medical text), written in black ink, with rubrications
scribe Masʿud ibn Ahmad al-Hafiz (Tusi text only)
binding later covers of dark-brown leather with ruled and stamped borders and paper pastedowns coloured with a pink wash
accession no. MSS 233

The first item in this manuscript (folios 1a–153a) is the second earliest recorded copy of the *Kitāb-i akhlāq-i Nāṣirī*, the Persian treatise on practical philosophy and ethics composed by the scholar, mathematician and astronomer, Nasir al-Din al-Tusi (d. 1274).[1] The copy was completed by Masʿud ibn Ahmad al-Hafiz at the end of Rabiʿ I 668 (27 November 1269), just over four years before the death of the author. The title page is filled with 11 different later notes, some now obliterated, including lengthy couplets and recipes attributed to Ibn Sina (Avicenna).

The second item in the volume is a fragment of an Arabic medical treatise, with marginal comments and corrections, copied by a different scribe. It commences below the colophon of the work by al-Tusi, on folio 153a, and continues to folio 154a, line 14. The title, probably a chapter heading taken from a larger treatise, is given as *Awjāʿ al-mafāṣil wa'l-niqris wa wajaʿ al-warak wa ʿirq al-nasā* ('Pain of the joints and gout and pain of the hip and sciatica'). No author is given, and the text is incomplete. It is written with catchwords, and although in a different hand from the first item it appears to be of approximately the same age. There are marginalia in different hands, and folio 154b is filled with six different miscellaneous notes. An owner's stamp dated AH 1333 (AD 1914–5) occurs on folio 1b and again on folio 154a.

1. The oldest copy is Tehran, University Library, MS.5464, which was made five years earlier. For other copies, see Brockelmann 1897–1902, p.510 (673); supplement, I, p.928. Since both copies were transcribed before al-Tusi's death, it is significant that neither contain what many scholars have believed to be the 'original' preface, nor a passage at the end of the treatise that some have suggested was deleted later for political reasons (see Beeston 1954, pp.58–9, no.2723). A chapter on one's duty to one's parents, which was inserted by al-Tusi in AH 663 (AD 1264–5) on the instruction of an important official, is missing from this copy only; *cf.* Minovi & Haydari 1978, pp.236–40 (this edition was based on the Tehran MS.5464); Wickens 1964, pp.178–81. The chapter was inserted between the fourth and fifth *faṣl* of the second *maqālah* (that is, on folio 102a of the present manuscript).

8

The *Tuḥfah al-Saʿdiyyah* of Qutb al-Din al-Shirazi

North-western Iran, *circa* 1305

195 folios, 32 × 24 cm, of a burnished, thick, cream paper with no visible laid or chain lines; text area 23.5 × 18 cm, with 25 lines written in black ink, with rubrications and occasional key words in blue; the script is *naskh*, unvowelled; folio 1a bears a dedication panel illuminated in ink, gold, blue and a reddish brown
binding modern
accession no. MSS 776
published Sotheby's, 12 October 1990, lot no.254

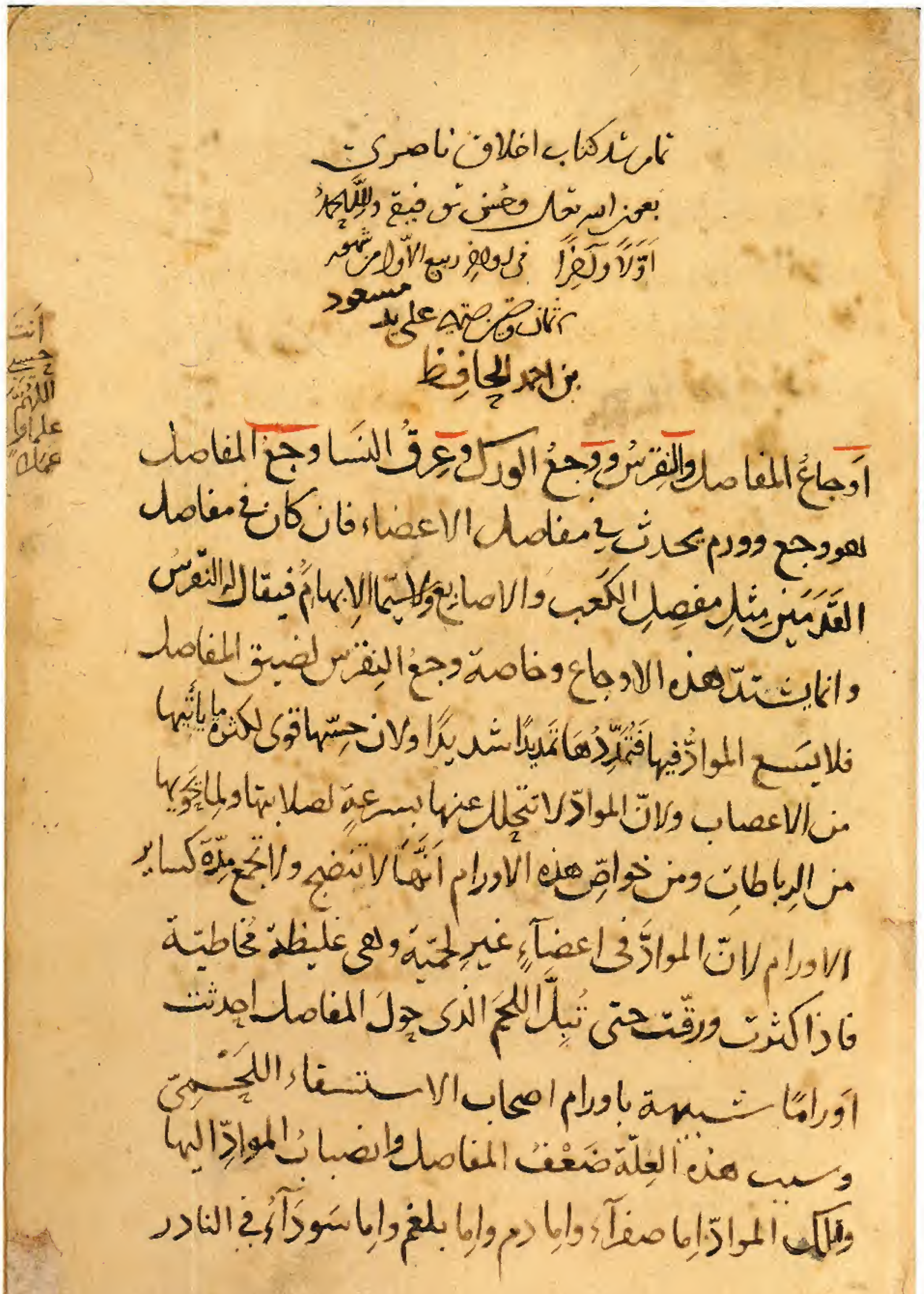
This manuscript contains part of the extensive commentary on the first of the five books of Ibn Sina's medical encyclopaedia, the *Qānūn fī 'l-ṭibb*, composed by Qutb al-Din Mahmud ibn Masʿud al-Shirazi, who died in Tabriz in 1311. The history of its composition, and an account of his medical education, is given by the author in the lengthy introduction. He began to write it in Shiraz while he was still a young man, and he continued working on it while travelling in Iran, Iraq and Syria. After his return to Iran he dedicated the work to Saʿd al-Din Savaji, vizier to Öljeytü, the Ilkhanid ruler of Iran from 1304 to 1317.[1] Al-Shirazi called the work *Nuzhat al-ḥukamā' wa-rawḍat al-aṭibbā'* ('The delight of the doctors and garden of the physicians'), as well as *al-Tuḥfah al-Saʿdiyyah* ('The present to Saʿd'), in honour of its dedicatee.

Cat.8 is undated, but on folios 1a, 19a and 195b there are impressions of the seal of one Aba Bakr ibn Hasan ʿAli, dated AH 705 (AD 1305–6), and on folio 1a there is a note in the name of al-Hasan ibn Nuh ibn Muhammad al-Tabib al-Shir[...], dated Rabiʿ I 772 (September – October 1370).[2] Since both titles of the treatise are given in this copy, including *al-Tuḥfah al-Saʿdiyyah* (folio 4a, line 23), and since this copy was apparently produced early in the 14th century, perhaps before the stamp dated 1305–6 was placed on it, it is possible that the treatise was dedicated to Saʿd al-Din Savaji early in his career as vizier, perhaps as a gift at the time of his appointment. Cat.8 may be the earliest recorded copy of the treatise.[3]

The illuminated panel – derived from Mamluk manuscripts – on folio 1a contains two short texts. The panels at the top and bottom are inscribed in Persian with the name of the author and a statement that the text is a commentary on the *Qānūn*, while the four lines of Arabic within the central hexagon declare that the work was copied for the library of a *qāḍī*, but he is not identified by name. At the top of folio 1b a *basmalah* in a fine *thulth* hand has been cut out of a separate sheet of paper and pasted on. The remainder of the text was copied in *naskh* by two hands. The first scribe was responsible for folios 1b–169b. This section contains marginal corrections by the scribe and has been collated with another manuscript by someone other than the original copyist. In addition, there are scattered marginalia and interlinear notes in various hands. The second scribe, who appears to have been a contemporary of the first but did not make corrections, copied folios 170a–195b. By this point the commentary had reached the fifteenth topic (*mabḥath*) in the introductory chapter (*faṣl*) of the fifth subsection (*taʿlīm*) of the first section (*fann*) of the first book (*kitāb*) of the *Qānūn*, and it finishes with a general discussion of the nature and variety of the parts of the human body, breaking off before Ibn Sina's detailed discussion of bones.

There are four seal impressions on folio 1a, including that of Aba Bakr ibn Hasan ʿAli. Two of them, one bearing the name Ibrahim ibn Khalil ibn Muhammad and the other the name Qarasnaqar ibn Abdallah, appear on MSS948 (ex-catalogue), and the latter of the two also occurs on QUR302 in the Khalili Collection.

1. Dietrich 1966, p.80; Schoeler 1990, no.212. Earlier scholars made Saʿd al-Din vizier to Öljeytü's predecessor Ahmad Tegüder, who reigned from 1281 to 1285 (Nicoll–Pusey 1835, p.160, note F; Wiedemann 1926–7).
2. In the Sotheby's sale catalogue, the date was read as AH 792 (AD 1390). The identical seal impression dated 705 also occurs on a manuscript offered for sale at Sotheby's, 26 April 1995, lot no.26.
3. An incomplete copy (Oxford, Bodleian Library, MS.Hunt.263) was made in mid-Rabiʿ II 707 (October 1307; Uri 1787, no. 605; Nicoll–Pusey 1835, pp.160, 523), while a manuscript now in Aleppo and another in Dublin were both produced in AH 721 (AD 1321–2). For the latter copies, see Dietrich 1966, pp.81–3; Kataya 1976, pp.87–93; Arberry 1955–66, no.3728.



تمام شد کتاب اخلاق ناصری
بعون الله تعالی وحسن توفیقه ولله الحمد
اولاً وآخراً فی اواخر ربیع الاول من شهور
ثمان وستین وستمایه علی ید مسعود
بن احمد الحافظ

أنت
حسبي
اللهم
علم او
عمله

اوجاع المفاصل والنقرس ووجع الورك وعرق النسا وجع المفاصل
هو وجع وورم يحدث في مفاصل الاعضاء فان كان في مفاصل
القدمين مثل مفصل الكعب والاصابع ولاسيما الابهام فيقال له النقرس
وانما تشتد هذه الاوجاع وخاصة وجع النقرس لضيق المفاصل
فلا يتسع المواد فيها فتمددها تمديدا شديدا ولان حسها قوى لكثرة ما يأتيها
من الاعصاب ولان المواد لا تتحلل عنها بسرعة لصلابتها ولما يحويها
من الرباطات ومن خواص هذه الاورام انها لا تنضج ولا تجمع مدة كساير
الاورام لان المواد في اعضاء غير لحمية وهي غليظة مخاطية
فاذا كثرت ورقت حتى تبل اللحم الذي حول المفاصل احدثت
اوراما شبيهة باورام اصحاب الاستسقاء اللحمي
وسبب هذه العلة ضعف المفاصل وانصباب المواد اليها
وتلك المواد اما صفراء واما دم واما بلغم واما سوداء في النادر

7, folio 153a

معرفته وهو استعمال المسهل مثلا من انه يستعمل في الابتداء لهيجان المرض وبعد ظهور النضج لكونه وبخوه كالطلا ومثلا من انه ينبغي ان يطول مدة ملازمته

او يحتمى سوء عيه الى غير ذلك على ما يطلع عليه في الى العلاج ان شاء الله تعالى فحال الشيخ اذا حاول اقامة البرهان على القسم الاول فلا يجب ان يكاول

ذلك من جهة انه طبيب ولكن من جهة انه يجب ان يكون فيلسوفا يتكلم في العلم الطبيعي كما ان الفقيه اذا حاول ان يثبت صحة وجوب اتباع الاجماع فليس له

ذلك من جهة ما هو فقيه ولكن من جهة ما هو متكلم ولكن الطبيب من جهة ما هو طبيب والفقيه من جهة ما هو فقيه ليس له ان يبرهن على ذلك

والاوقع الدود ذكر في بعض كتب التواريخ ان الفيلسوف لما كان انما يلقب به من تمهر في جميع اجزاء الفلسفة واحب جالينوس ان يدعى فيلسوفا

صنف في جميع اجزائها كتبا وعرضها على كل من ملوك زمانه وسأله ان يلقب به فقال الملك نحن ما نعرف هذه العلوم ولا مرتبة هذه الكتب فالاولى ان

بعثها الى فلان فيلسوف كان في زمانه فان استحسنها يلقبك به فلما رآها قال مصنفها لا يستحق هذا اللقب انما هو رجل طبيب وكان الشيخ

يشير بقوله يجب ان يكون فيلسوفا الى هذه الحكاية ان سمعها والا الى انه كثيرا ما يراه يخلط العلوم بعضها ببعض فعل المتفلسفين واما قول

المسيحي ان من الناس من يقرأ يجب بالحاء ومنهم من يقرأها بالجيم وهذا هو الواجب فان مثل الفاضل جالينوس لا يقال في حقه يجب ان يكون

فيلسوفا فهما يستحق ان يضحك منه لانه تصحيف ظاهر وخطأ فاحش لانه يجب على جالينوس مثلا ان يكون حيوانا لكونه انسانا فكذا لا يجب

عليه ان يكون فيلسوفا لكونه طبيبا سلمنا انه يجب ان يكون فيلسوفا لكن هذه الجملة لا يقتضي تجاوزه خلط العلوم بل تباينها ثم اي باس في قراءتها

بالجيم اللهم الا اذا كان من جنس من سئل عندنا الباذام وهو اللوز بالعربي قال الشوا ليس فقيل من اي كتاب فقال من القدوري بحاد

بالكتاب واذا فيه الشوآء ليس بادام حتى لو حلف انه لا ياكل اداما واكل شواء لا يحنث فصحح الى ان الشواء ليس باذام ومثل هذا لا يكون

انسانا بل نسناسا وكان هذا انما ذهب اليه وهم كما ذهب ابنه كما نبهت عليه رحمه كثير لكنه ينسبها الى النسخ والناس للتزوج واني

تزوج والتاء للتصحيف فان قيل صحة وجوب متابعة الاجماع من علم اصول الفقه فكيف جعلها الشيخ من علم الكلام لا يقال كما

قاله القرشي وغيره انه يعني بعلم الكلام ما يعم العلمين لانا نقول هذا ما لا ينبغي ان يقول فضلا عن فاضل مثله بل يقال لما كان

الاصولي انما يبحث عن احوال الادلة الموصلة الى الاحكام الشرعية واقسامها واختلاف مراتبها وجهات دلالاتها وكيفية استنباط الاحكام منها

على وجه كلي كان موضوع اصول الفقه الادلة الموصلة الى الاحكام الشرعية وهي الكتاب والسنة والاجماع والقياس والاستدلال

ولان اثبات وجود الموضوع ان لم يكن بينا كون كل من الخمسة دليلا شرعيا اي حجة مفيدة للاحكام شرعا ليس على صاحب العلم بل على صاحب

العلم الاقدم على ما عرفت وانما عليه افادة تصوراتها على ما قاله الشيخ ولهذا كان قدماء الاصوليين يقتصرون على ذكر حدودها

لافادة تصوراتها ويتركون للمتكلم كونها ادلة شرعية ثم يسطرون في اقسامها وجهات دلالاتها وغير ذلك لكن لما كان كون الكتاب والسنة

حجة كالمبادي العامة لاصول الفقه لرجوع مستند الاجماع اليها ورجوع القياس والاستدلال الى معقول النص والاجماع امتنع

بيان كونها حجة فيه بخلاف كون الاجماع والقياس حجة فانها لو لم يكونا كالمبادي العامة صح بيان كونها حجة فيه ولهذا اقتصر بعض متأخريهم

على حدي الكتاب والسنة واطالوا في بيان كونهما حجة على الكلام وتبينوا كون البواقي حجة فيه والاكثرون بينوا كون السنة حجة فيه ايضا

لانها ليست كالكتاب في عموم الرجوع اليها ولا مكان بيان كونها حجة بالكتاب واما ان كلا من الفقيه والطبيب من حيث هو فقيه وطبيب

بادام

8, folios 18b–19a

ذلك الغرض وكما صحت اضافة هذه المعرفة الى التأمل والنظر صحت اضافتها الى الحس والتشريح لكونها موقوفة عليها فانه كما يصح اضافة معرفة الله
تعالى الى النظر والفكر يصح اضافتها ايضا الى المصنوعات فيقال عرفت الله تعالى بمصنوعاته وان لم تكن تلك مفيدة للمعرفة فكذلك ههنا هذا
بيان الشيخ لما فرغ من الكلام على القسمين المذكورين من الثلثة اشار الى الثالث وقال رحمه الله والذي يجب ان نعرفه ونبرهن عليه
الاعراض واسبابها الجزئية وعلاماتها وانه كيف تزال المرض وتحفظ الصحة انما قيد الاسباب بالجزئية لان البرهان على اسبابها الكلية وهي الفاعلية
والمادية والصورية والغائية ليس عليه بل على الالهي كما عرفت وانما كانت هذه كلية لشمولها جميع الامراض وعدم اختصاصها ببعض
منها بخلاف الاسباب الجزئية المندرجة تحت الاسباب الكلية وان كانت كلية باعتبار آخر والخونجي والايلاقي لما لم يتنبها لهذه الدقيقة جعلا
الجزئية قيد الامراض وقالا الذي يجب ان نبرهن عليه الامراض الجزئية واسبابها وعلاماتها وهو خطأ ظاهر لفظا ومعنى اما لفظا فلان الجزئية
لو كانت قيدا للثلثة لاخرها عنها لا ان وسطها واما معنى فلانه يجب عليه ان يبرهن على الامراض سواء كانت كلية كسوء المزاج المطلق او جزئية كالحار
وكذا على العلامات كلية كانت كعلامات سوء المزاج المطلق او جزئية كعلامات سوء المزاج الخاص ولان الامراض قد تكون بينة كالاورام و
الخراجات الظاهرة وكذا اسبابها كالامتلاء وسائر الاسباب البادية وكذا الاعراض قد تكون خفية كامراض الاعضاء الباطنة التابعة
الاعراض منها قال رحمه الله فانه يلزم ان يعطي البرهان على ما كان من هذا خفي الوجود بتفصيله وتقديره وتوقيته وفي بعض النسخ
وتقديره وتوفيته اما تفصيله فبان يبرهن على كون المرض مثلا هو الحمى ثم كونها صفراوية ثم كونها غب دائمة ثم كونها خالصة وهكذا حتى يعرف المرض
بجميع فصوله ويفصله عن كل ما عداه وبالجملة يتدرج من الجنس العالي الى اخص ما يكون على ما ذكره جالينوس في كتاب علوص والمراد
بالبرهان هو الطريق القياسي الذي يليق بالطب لا القياس المؤلف من المقدمات اليقينية ومن هذا القبيل ما ذكره القرشي من ان التفصيل
هو مثل ان سوء المزاج ان كان في مقدم الدماغ اضر بالحس وان كان في وسطه اضر بالفكر وان كان في مؤخره اضر بالذكر لان تفصيل المرض
تشخيصه وتمييزه عن كل ما عداه ونحو ما ذكرناه اظهر منه مما ذكره واما تقديره فبان يعرف مقدار المرض بالشدة والضعف وانه هل خرج
خروجا كثيرا او قليلا والمراد من تقريره على ما في بعض النسخ ان يعرف هل المرض مستقر او سيحكم او هو في طريق الحدوث والكون لاختلاف التدبير
بحسبها والظاهر انه تصحيف التقدير لان التوقيت يغني عنه واما توقيته فبان يعرف ان المرض في الابتداء او التزيد او الانتهاء او الانحطاط
فان التدبير بالدواء يختلف بحسبها كما سبق في الاورام الحارة وكذا بالغذاء على ما يجيء ان شاء الله العزيز والمراد من توفيته على ما في بعض النسخ وان
كان الظاهر انه تصحيف توقيته اعطاء حقه وافيا وذلك يستلزم معرفته بالتفصيل والتقدير والتوقيت لتوقف الاعطاء على معرفة الثلثة
هذا في المرض واما في العرض فتفصيله معرفة اختصاصه بالمرض كالحمى والسعال والوجع الناخس والنبض المنشاري وضيق النفس
بذات الجنب وتقديره معرفة قوته وضعفه وتوقيته معرفة اوقاته فان من الاعراض ما يختص بالابتداء كاشتداد العطش والقلق والسهر
في الحمى الصفراوية الخالصة لعدم النضج ومنها ما يختص بما بعده كظهور علامات النضج وعلامات البحران ومنها ما يدوم بدوام المرض كاختلاف
النبض في الحمى فيكون ذلك طريقا في معرفة اوقات المرض ايضا واما في السبب فيعرف كل ذلك ايضا واما في العلاج فتفصيله معرفة انه يحتاج
الى المسهل ثم مسهل الصفراء ثم مسهل الصفراء وحدها وتقديره معرفة قوة الدواء شدة وضعفا ومقداره كثرة وقلة وتوقيته

9

Fragment of a medical encyclopaedia

India, perhaps 1710

2 folios, 34.3 × 21 cm, of a thin, highly burnished paper with laid lines but no chain lines; text area 25.1 × 13.2 cm, with frames in black, gold and grey-blue enclosing 27 lines of *nasta'līq* written in black, red and gold; folio 1a is blank except for a frame; folio 1b has a head-piece inscribed in white *thulth* with the section title and illuminated in gold, black, yellow, orange, brick red, purple and mauve; the margins of folios 1b and 2a are ornamented with floral motifs executed in gold on a natural ground within a second, outer frame in black, gold and red
accession no. MSS 760.1–2

This two-folio fragment contains the opening and beginning sections of the fourth book of the *Dhakhīrah-i Khvārazmshāhī* ('Thesaurus for the Khwarazmshah'), the Persian medical encyclopaedia by Isma'il ibn Husayn al-Jurjani (d. 1135). This work, which was completed shortly after AH 504 (AD 1110–11), is a comprehensive medical compendium divided into nine books, to which a tenth, on medicaments, was later added. The *Dhakhīrah-i Khvārazmshāhī* became the most widely read medieval medical treatise written in Persian, and while a considerable number of copies are preserved today, few are as fine as the manuscript of which this fragment once formed a part.

The first folio contains an illuminated opening for the fourth book (*kitāb*), on the diagnosis and prognosis of disease, with the title of the treatise written as *al-Dhakhīrah al-Khwārazmshāhī* (*sic*) in white on the gilt band. The fourth book consists of four subsections, or *guftārs*, and this fragment, following a brief table of contents for the book, contains the text of the entire first *guftār* and most of the second, breaking off shortly after the beginning of the third *wajh* of the fifth *bāb* in the second *guftār*. The author is not named in the fragment. A comparison with other copies, however, confirms the identification.[1]

The fragment is undated, but its calligraphy and illumination would suggest a product of India in the early 18th century. The two leaves were previously mounted, and on the back of the mount there is a note, '34. From Arabic [*sic*] Manuscript (Medical) – dated 1710. Text in Naskhi and Nastalic – INDIA (Deccan?) early 18th cent.'

Although it is usually claimed that the *Dhakhīrah* was the first major medical treatise to have been written in Persian, an earlier medical compendium was written in the language by Abu Bakr Rabi' ibn Ahmad al-Akhawayni al-Bukhari (d. AD 983),[2] and a metrical medical handbook was completed in AD 980 by one Hakim Maysari.[3] The earlier works were not, however, as influential and widely read as that by al-Jurjani. His encyclopaedia was translated into Turkish, Urdu and Hebrew, and Arabic summaries were produced, but it was never translated into Latin and consequently remained unknown in Europe.

1. The fragment corresponds to the section in the Bodleian MS.Elliott 180, folio 122a, line 11, to folio 123b, line 7, and to the section in Bodleian MS.Fraser 200, folio 298a, line 2, to folio 301a, line 17. Both of these manuscripts are copies of al-Jurjani's medical encyclopaedia, the former copy finished in AH 744 (AD 1344), and the latter in AH 1134 (AD 1722). For these manuscripts, see Sachau & Ethé 1889, nos 1576, 1578.
2. An edition of this text was published in 1965; see Bukhari.
3. See Maysari for a recent edition of the *Dānishnāmah*.

10

The *Ikhtiyārāt-i Badī'ī* of Hajji Zayn al-'Attar

India, dated 5 Dhu'l-Hijjah 1058 (21 December 1648)

213 folios, 32.6 × 18.5 cm, of a blue dyed paper with wavy vertical laid lines and single chain lines; on folios 1a–195a the text area, 24 × 12 cm, is framed by single red rules and contains 21 lines of a *naskh* hand with some tendency toward *nasta'līq*; written in black with rubrications, the text accompanied by numerous small illustrations executed in ink and opaque watercolours; folio 195b is blank except for a frame of red rules and two later notes; folio 196a is blank except for later notes; folios 196b–213b have an unruled text area 23.5 × 12 cm, with 22 lines of *nasta'līq*, written in black with rubrications
scribe Hasan Beg ibn Hajji Lutf Allah Yazdi, known as Qassab
binding outer covers and envelope flap of maroon leather, with borders ruled in gold and press-moulded medallions and pendants showing traces of gilt, and doublures of yellow-green leather
accession no. MSS 973
published Christie's, London, 17–19 October 1995, lot no.56

The volume contains a rare illustrated copy of the *Ikhtiyārāt-i Badī'ī* ('Selections for Badi''). This is a comprehensive pharmacopoeia of simple and compound remedies composed in Persian in AH 770 (AD 1368–9) by 'Ali ibn Husayn Ansari Shirazi, known as Hajji Zayn al-'Attar, perhaps for the Muzaffarid princess Badi' al-Jamal, who is named in the title of the treatise but of whom very little is known. Hajji Zayn al-'Attar, who died in AH 806 (AD 1403–4), was for 16 years the court physician to the Muzaffarid ruler Shah Shuja' (*reg.* 1358–1384).[1]

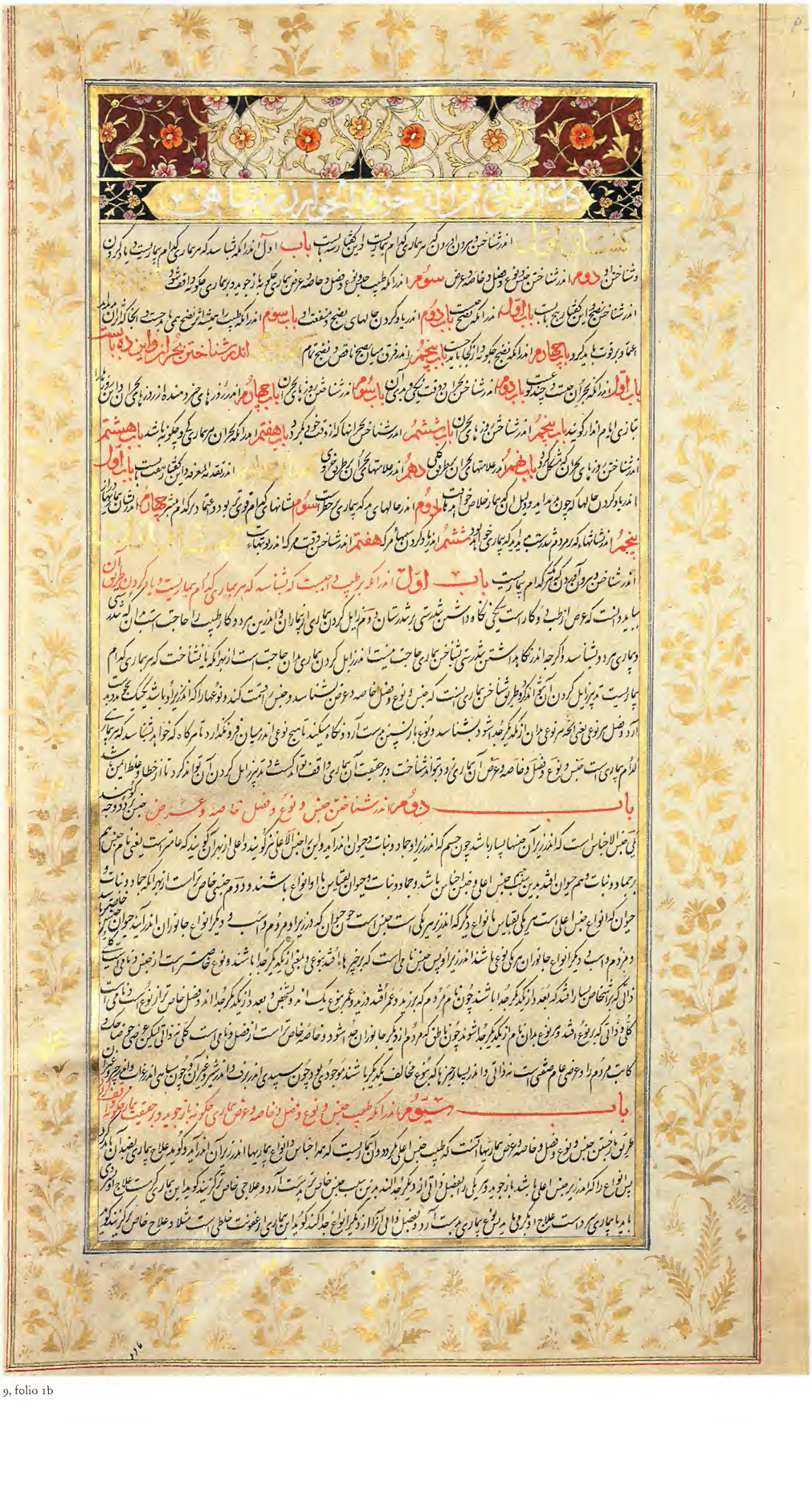
The treatise is in two parts: the first section (*maqālah*) presents medicaments in alphabetical order in 28 chapters (*bāb*). The second is a formulary of compound remedies, arranged in 16 chapters according to type, such as cordials, digestives, infusions, collyria and so forth. In this copy the first section (folios 1–195) is copiously illustrated with paintings of most of the plants and animals from which the medicinal substances are to be extracted.

This pharmacopoeia was clearly very popular, as over 80 manuscript copies are preserved.[2] However, this is one of only two illustrated copies, the other being in Tashkent,[3] and it therefore seems likely that the original did not have illustrations. Those in cat.10 appear to have been taken from several traditions of illustrated materia medica, including works based on Dioscorides and copies of the *Kitāb 'ajā'ib al-makhlūqāt wa-gharā'ib al-mawjūdāt* ('Marvels of things created and miraculous aspects of things existing') of Zakariya' ibn Muhammad al-Qazwini (d. 1283), which often have illustrations of plants and animals.[4]

The short introduction (*muqaddimah*) to the treatise is fragmentary in this copy,[5] with the alphabetical listing of medicaments beginning on folio 3b. The second section of the treatise (folios 196b–213b) is unillustrated and imperfect after the twelfth chapter, with fragments only of the thirteenth and fifteenth chapters. Both sections of the treatise were written by the same scribe, who gave his name and the date of completion at the end of the first half (folio 195a). The author is named on folio 1a, line 2, while the title of the treatise occurs on the final folio of the first section (folio 195a).

Owner's stamps occur on the first and last folios of the first part, one of them giving the name Habib Allah al-Husayni, and there are owner's notes on folios 195b and 196a. Occasional marginal corrections and marginalia have been inscribed in several hands, including medicinal uses apparently added by the scribe. Folios 178 and 183 and folios 187 and 192 have been inadvertently exchanged, and the leaves have been paginated in pencil in an Indian hand.

1. For sources regarding his life, see Richter-Bernburg 1978, p.32. An edition of the text was published in Shiraz in 1993 (see Hajji Zayn al-'Attar).
2. See Storey 1971, pp.221–2; Richter-Bernburg 1978, p.33. There are additional copies in Bethesda, MD, National Library of Medicine, MS.P9, completed in 1641; and Charleston, SC, Charleston Library Society, copy dated 1492; 11 copies in Los Angeles, University of California, Bio-Medical Library, Collection 1117 (Richter-Bernburg 1978, nos 20–30); 15 copies in London, Wellcome Institute for the History of Medicine (Keshavarz 1986, pp.257–61, no.124).
3. Tashkent, Academy of Sciences, MS.I.636, copied in AD 948 (AD 1541); see Ettinghausen 1965, pl.XLVIa, for an illustration from the manuscript.
4. For Indian copies of al-Qazwini's treatise with illustrations somewhat similar to some of those in this manuscript, see Bethesda, MD, National Library of Medicine, MSS P1, copied in AH 944 (AD 1537–8), P2, an undated 17th-century copy, and P3, an undated 18th-century copy.
5. The text on folio 1a begins at a point equivalent to p.8, line 6, of the 1993 edition (see Hajji Zayn al-'Attar).



کتاب الرابع من الذخیره الخوارزمشاهی

باب اول اندر آنکه بر طبیب واجب است که بشناسد که هر بیماری کدام بیماریست و یاد کردن طریق آن

باب دوم اندر شناختن جنس و نوع و فصل و خاصه و عرض

باب سوم اندر آنکه طبیب جنس و نوع و فصل و خاصه و عرض بیماری چگونه بازجوید

9, folio 1b

کنند وسحق کنند طلایی نافع بود جهت بواسیر بادنجان زرد با روغن بزر بپزند واز آن موم روغن سازند و بر شقاق
کعبین ومیان انگشتان طلا کنند نافع بود واگر گل وی با روغن بادام تلخ بجوشانند بروغن بنفشه بسرشند وبر بواسیر
طلا کنند ببرد واگر بادنجان بسوزانند وخاکستر آن با سرکه بسرشند وبر ثؤلیل طلا کنند ببرد وثالیل را بشیرازی
کوک خوانند وگویند مقوی معده بود وقطع نزف دم بکند بخاصیت وخوردن وی اولی آن بود که در آب نمک بجوشانند
یا سلوق کنند وبا روغن کنجد یا با دام بریان کنند یا با سرکه وگوید بابونج بپارسی بابونه گویند بهترین آن
بود که گل وی زرد وبزرگ بود وطبیعت وی گرم وخشک است در اول مفتح وملطف بود ومحلل بی جذب وورمهای صلب
را نرم کند وصداع سرد را نافع بود وهم تبها را زایل کرداند ودفع کند خاصه که از عفونت سودا بود وبلغم
وورمهای احشا واگر بجوشانند ودر آب آن نشیند سنگ گرده بریزاند وحیض وبول براند وبچه بیندازد

واگر بیاشامند بول وحیض براند وبچه در وقت زادن سهل بیرون
آید وبدن را پاک کرداند تنقیه تام واگر بر جرب تر ضماد کنند ببرد وقوت
اعصاب ودماغ بدهد وبر ورم حکه ضماد کنند نافع بود وبخار وی دماغ
تنها بخایه سود دهد واگر با آب وسرکه بپزند ودر آخر دهد بوسر بو بخار آن
دارند چشم را پاک کند ودرد زایل کند اگر آرمان کند واگر چشم بآب بابونه
تنها بشویند درد ساکن کرداند واسحق بن حنین گوید مضر است محلل ومصلح وی عسل است وبدل آن در
تقویه دماغ وزایل کردن صداع سرد برنجاسف است بادروج حوک خوانند وآن نوعی از ریحان کوهی است

در دامن کوهها روید طبیعت وی گرم است در دوم وخشک است
در اول وگویند رطوبتی فضلی در وی است بهترین وی آنست که خوشبوی
بود ووی از ادویه قلبی باشد واگر عصاره وی در چشم کشند چشم را جلا دهد
ورطوبتی که از چشم رواد بود خشک کرداند واگر بسیار بخورند تاریکی چشم
آورد وشکم نرم دارد اما باه را برانگیزد ومولد ریاح بود وبول براند
اما دشوار هضم بود واگر بر گزندگی زنبور وعقرب ضماد کنند نافع بود واگر با روغن گل وسرکه وپست جو بر ورم
گرم ضماد کنند نافع بود وخوردن وی گویند کرم در شکم پیدا کند وچون بخایند ودر آفتاب نهند کرم از آن تولد کند

10, folio 22a

نافع بود وچون چهار درم ازوی با ماء العسل بیاشامند بچهٔ مرده وزنده بیندازد وچون دو مثقال بعسل

بیاشامند قی آورد وکرم در شکم بکشد و منضج ورمهاء کرم
بود شریف آورده است که اکر بر قضیب بمالند شهوتها او را روان کنند قضیب
ستبر و قوی کند واکر سه عدد پیاز نرکس در شیر خیسانند یک
شبانه روز و بر قضیب طلا کنند اکر عنّین بود باز حال صحت آید
بصاق القمر رغوة القمر و زبد القمر کویند وآن حجر القمر است وگفته شود بطّیخ بپارسی خربزه کویند
بهترین وی سمرقندی بود شیرین وقول اکثر آنست که سرد است در اول درجهٔ دوم و تر است در آخر
وبعضی کویند کرم است ودر حقیقت چون شیرین بود کرم و تر است ادرار البول کند وسنک کرده

و مثانه بریزاند و کلف و بهق و وسخ زایل کند و در تخم وی
جلا بیشتر بود که جرم و پوست وی چون بر پیشانی چسپانند
منع نزول آب بکند و خوردن کوشت وی سنک بریزاند و بیاشامند
قی بی زحمت آورد وخربزه مستحیل کردد بدان خلط که در معده
زیادت بود مرخی احشا بود و معده و هیضه آورد واکر در
معده تباه کردد سم شود ومصلح آن سکنجبین است که بعد از وی بخورند و باید که میان دو طعام بخورند
واکر در معده تباه شود البته قی کنند و در معده رها نکنند واکر پوست تر وی در حمام در خود مالند
اندام را پاک کرداند خاصه لون روی واکر خشک کرده عوض اشنان دست بدان بشویند زهومت
زایل کند واکر پوست وی با کوشت کاو بپزند زود از معده بکذرد واکر پوست وی خشک کرده
در دیگی که کوشت غلیظ بود اندازند زود بپزد و مهرا کردد بطّیخ زنجی بطّیخ هندی است وبطّیخ

سندی نیز کویند بپارسی خربزهٔ هندی خوانند وبشیرازی
خیار کدو وبتبریزی هندوانه بهترین آن بود که ابدار شیرین
باشد وطبیعت وی سرد است در دوم نافع بود جهت مرضهای
کرم و تبهای محرقه ومزاجهاء کرم نافع بود ودفع تشنکی بکند

10, folio 30a

11

The *Ṭibb al-Nabawī* of Ibn Qayyim al-Jawziyyah

Probably Damascus, dated
21 Shawwal 926 (4 October 1520)

76 folios, 17.7 × 12.3 cm, of a burnished, cream paper with visible laid lines and chain lines in groups of three; text area 13.4 × 7.7 cm, with 21 lines written in black ink with rubrications and occasional gilt headings; the script is *naskh*, unvowelled; *tuğra* of Sultan Süleyman I on folio 1b in gold outlined in dark blue; illuminated title and dedication on folio 2a predominantly in gold and dark blue; second *tuğra* of Sultan Süleyman on folio 75a in dark blue outlined in gold
scribe ʿAbd al-Rahman ibn Mawhub al-Dimashqi al-Mutatabbib
binding brown leather over boards, with stamped and painted central medallions and blind-tooled frames, lined with pink paper
accession no. MSS 568
published Geneva 1995, no.43

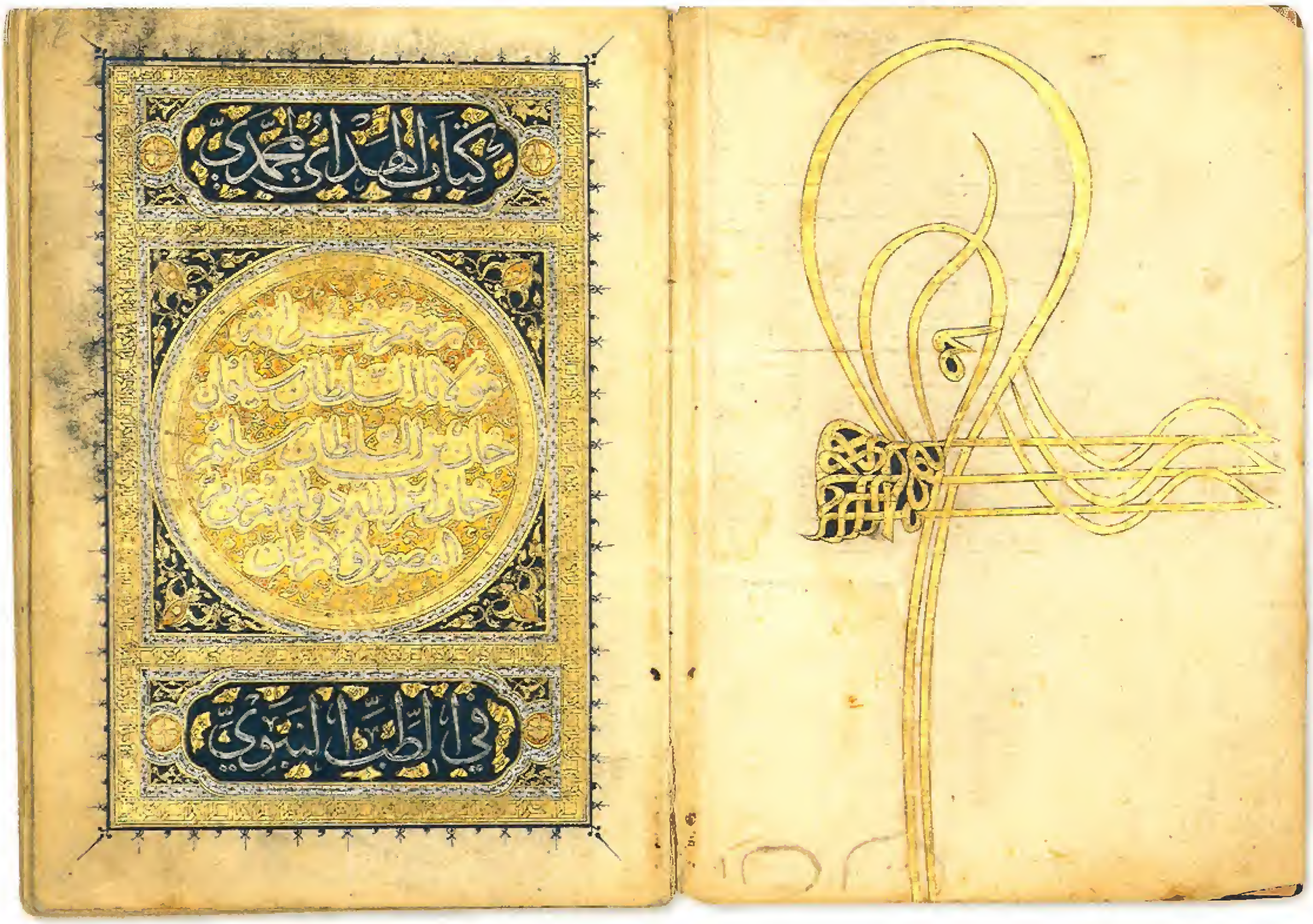
This treatise on Prophetic medicine (*al-ṭibb al-nabawī*) opens and closes with a large *tuğra* of Sultan Süleyman the Magnificent (*reg.*1520–1566), and the dedication on folio 2a and the colophon on folio 74b record that the manuscript was commissioned by or for Süleyman while his father, Sultan Selim I, was still alive. That Selim was still living is indicated by the prayers placed after the name of 'Sultan Süleyman Khan, the son of Sultan Selim Khan'. These are, in the first instance, 'May God exalt their dynasty during the passing of the ages and eras!', and, in the second, 'May God make their dominion eternal!'[1] It is also worthy of note that the manuscript was completed only 12 days after Sultan Selim's death on 9 Shawwal 926 (22 September 1520) and just three days after Süleyman reached Istanbul from his former residence of Manisa, on 17 Shawwal (30 October).

As a scribe working in Manisa or Istanbul at this date would have been aware of the change in Süleyman's status, it is clear that the manuscript was produced elsewhere, and the style of illumination and the scribe's *nisbah*, al-Dimashqi, suggest that it was copied in Damascus. The presence of the *tuğra*s indicates that it was passed to a charitable institution that Süleyman patronized, perhaps one in his princely residences of Manisa.

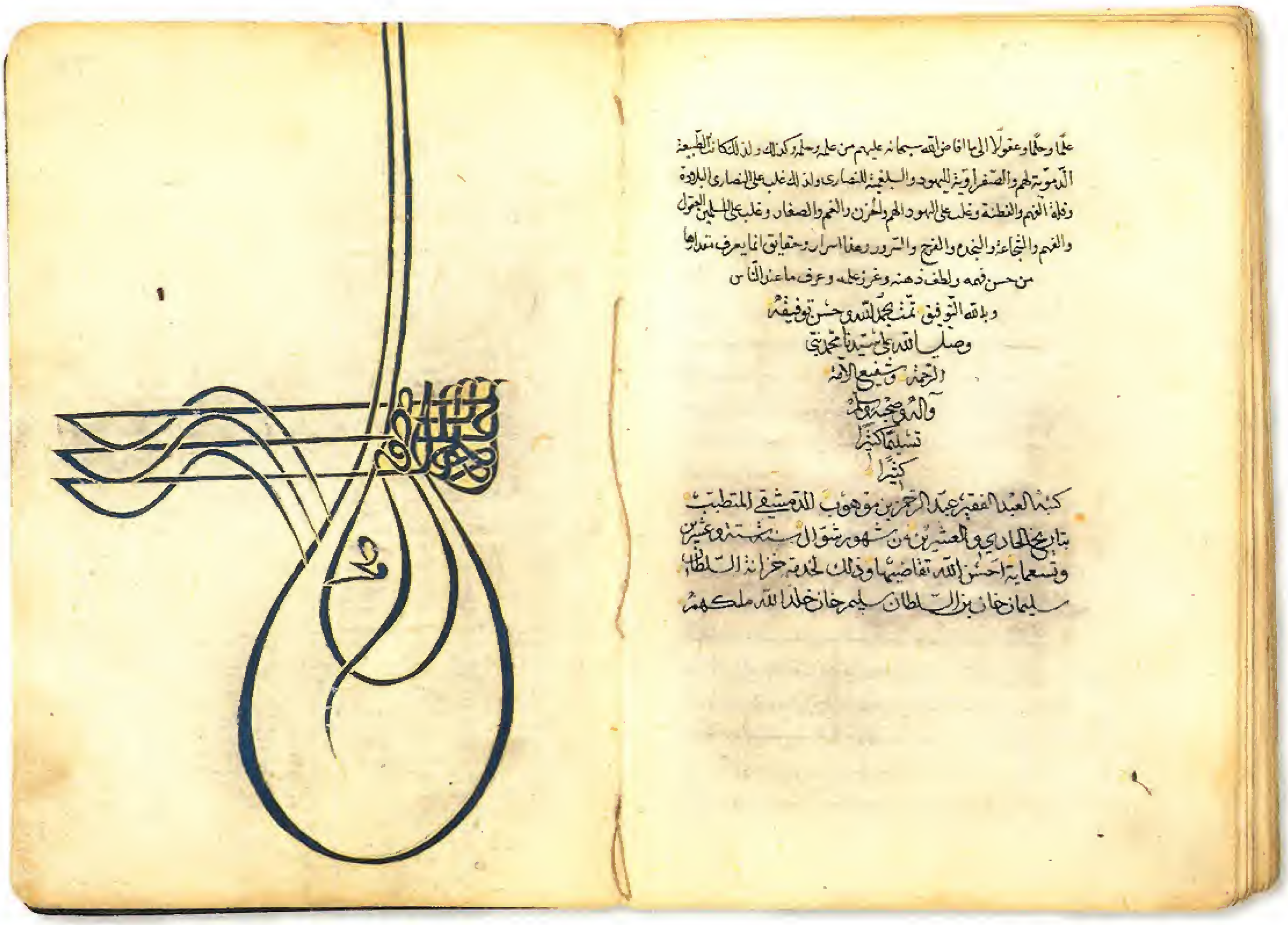
The title of the treatise is given in the upper and lower panels of the frontispiece as *Kitāb al-Hady al-Muḥammadī fi'l-ṭibb al-nabawī*, 'Book of the Muhammadan path in prophetic medicine'. No author is given, but comparison with other works on this subject indicates that it is a complete copy of the treatise on Prophetic medicine by the Hanbali theologian Ibn al-Qayyim al-Jawziyyah, a prominent defender of traditional religious propriety who died in 1350.[2] Ibn al-Qayyim al-Jawziyyah's treatise is preserved today in a number of manuscript copies and has been recently published in two editions.[3] It was known as *Zād al-maʿād fī hady khayr al-ʿibād* ('Provisions of essential matters for the path of the best of servants [of God]'), or more often simply as *al-ṭibb al-nabawī*, ('Prophetic medicine'). The title of the treatise given in the present copy is unusual, but there is evidence that some later writers on the subject referred to Ibn al-Qayyim's treatise by a similar title.

1. It is curious that the copyist used the plural rather than the dual in these expressions.
2. Ullmann 1970, p.187; Livingston 1992; and Dols 1992, pp.249–60.
3. The text from folio 2b, line 2, to folio 74b, line 7, correponds to that in Ibn al-Qayyim – Arna'ut, pp.6–415 (to line 15, with the following title omitted); Ibn al-Qayyim – Jamili, pp.41–433.
4. Al-Surramarri (d. AD 1374), for example, apparently referred to Ibn Qayyim's treatise as *Kitāb al-hady*, or possibly *Kitāb al-hudā*. See Dietrich 1966, p.120, n.1.

11, folios 2b–3a



11, folios 1b–2a



11, folios 74b–75a

A medical, pharmaceutical or perfumery utensil

by Emilie Savage-Smith

More than 35 early Islamic glass vessels similar to cat.12 in the Khalili Collection have been recorded. Their intended function is uncertain, though a number of possibilities have been suggested, including their use as cupping-glasses, small alembics, funnelled cups for transferring small amounts of liquids, breast relievers, baby bottles and invalid feeders. There are arguments against most of these hypotheses, as we shall see, and no description of such objects has been discovered in the medieval Islamic literature.

None of the surviving examples is known to be intact: the elongated hollow stems or spouts are broken in every case, so that the overall length when complete is indeterminable, and consequently the original form is difficult to know with certainty. Of the preserved specimens, some are so fragmentary that little can be said regarding the form of the stem at all.[1]

Some, however, have a substantial part of the stem intact, and its position relative to the 'cup' can be observed. On many, the stem clearly curves downwards from the rim of the cup towards and occasionally even past the bottom. In addition to the example in the Khalili Collection, 16 other vessels of this form are known to survive.[2] Others have virtually straight stems that project at right angles to the body and are usually, though not necessarily, attached to the cup near the rim.[3] One example is recorded as having a curved stem that angles first towards the bottom of the cup before turning back towards the plane of the rim.[4] This vessel probably had a different function from the rest, most likely as a small alembic. It has been suggested that the others mentioned above were also alembics or some form of small distilling apparatus.[5] Their stems, however, project out and curve at an angle that would prevent their functioning as alembics. They might, nevertheless, have been used as chemical apparatus to transfer a small amount of liquid to a bottle with a narrow neck, to measure liquids, to separate liquids of different specific gravities, or to heat small quantities of liquid.

The extant Islamic glass vessels of this type have been variously dated from the 7th to the 12th century. Though most do not have securely dated provenances, some were found in Iran, at Susa,[6] Nishapur[7] and four 'presumably' at Rayy,[8] one of which is thought to date to the 6th or 7th century and the others between the 9th and 11th centuries. Others of a similar age have been found in Syria.[9] The site that has yielded the most reliably dated objects is Fustat (Old Cairo), where eight examples have been found in levels securely dated to the period between the 9th and 11th centuries.[10] Those with straight stems, as well as those with stems curving away from the rim, have been found in both Iran, Egypt and Syria. A more comprehensive survey of the artefacts needs to be undertaken in order to determine if there were regional differences in design or, indeed, whether there were many different places of production or whether the vessels were distributed from only one or two sites. If they were associated with the perfume trade, as will be suggested below, their very broad distribution might be accounted for in the same way as that of molar-tooth shaped perfume bottles,[11] for they would have been a necessary part of the equipment of any perfume vendor.

Another puzzling feature of these glass vessels is the apparent cessation of production. It would seem that after the 12th century such items became uncommon. For a once-popular item to cease to be made when the need for it continues presents a perplexing problem to the historian. It could be that the glass vessels were replaced by pieces of equipment made of more mundane materials.[12]

Cupping-glasses

It has often been suggested that these objects were used as cupping-glasses but,[13] while suction can be produced by placing such a vessel against the skin and extracting the air

through the hollow stem, the known pieces do not correspond to the descriptions and drawings of cupping-glasses that occur in Islamic medical literature of the period. Al-Zahrawi, writing in Spain in the 10th century, for example, says that cupping-vessels (*maḥājim*) could be made of horn, wood, copper (*naḥās*) or glass, though his attention is directed mostly to those of metal.[14] The shape of all al-Zahrawi's examples is similar to that of classical and Byzantine copper-alloy cupping-vessels – that is, round in cross-section and of a bellied or gourd-like form.[15] A contemporary of al-Zahrawi in the eastern provinces, Muhammad ibn Ahmad al-Khwarizmi, stated in a treatise dedicated to a Samanid ruler in Transoxiana and Khurasan that an alembic or still-head was 'in the shape of a cupping-glass [*miḥjamah*]', though the final word could also be read as 'skull' (*jumjumah*).[16] Whichever term is the original, the image is that of a bulbous object which contracts slightly near the rim, and on only one preserved glass utensil is the stem curved in the direction required for an alembic.[17]

According to al-Zahrawi, Islamic cupping-vessels varied in their dimensions, from large ones the size of a clenched fist to small ones the size of a walnut. There was no handle or hollow stem, but there was a pinhole to serve as a valve. The suction necessary for cupping was produced by heating the vessel over a flame or by placing a small burning wick on a bar across the middle of the vessel. Once the cup had been placed on the skin the expanding hot air was allowed to escape through the pinhole in the wall of the vessel. Then a finger was placed over the pinhole while the air cooled and a slight vacuum formed. Cupping might be accompanied by scarification and extraction of blood or it could be done without scarification, for the relief of pain and itching and also to stop haemorrhaging. The vessels could also be filled with plain hot water, or with hot water in which herbs had been boiled, and then applied to the body and held there for a while.

By the 16th century, according to the Italian physician and botanist Prospero Alpino de Maròstico (d. 1617), the Egyptians no longer knew of cupping-glasses that were heated to form a vacuum. At the time Alpino was in Egypt, between 1581 and 1584, glass cupping-vessels had long tubes through which the cupper extracted the air by suction, sealing the vessel thereafter by stopping the end of the tube with a small piece of leather that was attached by a tie to the vessel. These cupping devices, however, are of very different design to those found in early Islamic sites, for they are large kidney-shaped or rectangular objects, with a cylindrical extension on one of the smaller sides that was placed against the skin and a narrow tube extending from one of the larger sides.[18]

As for some of the other uses proposed for these intriguing objects, that of a feeder for an invalid or infant seems unlikely, for the thin and fragile glass spout would probably have proved rather dangerous.[19] With the exception of the one recorded item whose spout curves towards the rim of the bowl, and possibly some of those with straight stems, the curve of the stem is in the wrong direction for them to have been used as breast relievers, even assuming that the stem was originally long enough to reach to the woman's mouth while the cup was placed over the nipple.[20]

A druggist or perfumer's utensil

Apparent evidence for the use of such objects as cupping-vessels comes from illustrations in 13th-century copies of the *Maqāmāt* by al-Hariri (d. 1122), but it will be argued here that they also suggest an alternative interpretation of the objects as perfumer's utensils. In the 47th *maqāmah* ('session'), the trickster and wit Abu Zayd teams up with his son to fleece onlookers of their money.[21] Abu Zayd pretends to be a cupper and his son the potential

12

Glass utensil

Provenance unknown,
9th–11th century

Translucent green free-blown glass, with slight iridescence visible
height 5.8 cm *diameter of rim* 5.1 cm
length 10.7 cm (including stem)
length of stem 5.5 cm (broken)
accession no. GLS 454

The body of the vessel is roughly conical, with a rounded base with a pontil mark. There is a slight bulge below the wide aperture, which has a rolled rim. The hollow spout flares where it is attached to the side of the cup, then tapers and curves sharply away from the rim. The end of the stem is broken, so that its original length and diameter at the tip are unknown.

Many possible functions for this type of object have been proposed, the most frequent being that of a cupping-glass. The design also suggests that such vessels may have been common utensils used by perfumers and druggists when mixing small quantities of scent or medicaments and transferring them to small perfume or medicine bottles.

patient who wants the nape of his neck cupped but has no money to pay for it. In the medieval Islamic world, a cupper (*hajjām*) was of very low social status and was frequently satirized.[22]

In a number of the illustrated copies of the *Maqāmāt*, the cupper's place of business, which is unspecified in the text,[23] is represented as a domed structure containing shelves of equipment. In a copy completed on 6 Ramadan 634 (3 May 1237), probably in Baghdad, by the artist and calligrapher Yahya al-Wasiti, the charlatan Abu Zayd is shown as having placed on his son's back a hemispherical cup with a long straight stem which he is holding in his right hand. The end of the stem may be in his mouth, although this is not entirely clear.[24] Shelves overhead hold two similar vessels with short stems curving away from the rim and various bottles and containers.

Three other 13th- or 14th-century Syro–Egyptian copies of the story illustrate Abu Zayd cupping his son. In one of them Abu Zayd is shown holding the stem of a glass utensil of more cyclindrical shape, with the stem far away from his mouth.[25] Again, there are two similar items on the shelves above. In another copy, five of the vessels are shown in the background but Abu Zayd is about to place a straight tube on his patient's back.[26] In these copies a total of 11 such bell-shaped glass vessels, with stems bending slightly away from the rim, are shown either resting rim-side down on a shelf or suspended under a shelf, among a variety of equipment including a mortar and pestle,[27] objects that might be interpreted as knives with curved blades and storage containers with peaked or hemispherical lids.

In two other copies of al-Hariri's text, Abu Zayd is shown not actually cupping his son but addressing the audience. Here again, however, the shelves and cupboards in the background are shown to contain a variety of equipment. In one of the copies, there are two blue vessels much like the glass utensils under discussion, with very straight stems branching off near the rim and a white decorative band midway down the cylindrical body.[28]

The stories related by al-Hariri are satirical accounts of a clever and witty trickster, and the illustrator might intentionally have contributed to the humour of the account by depicting the charlatan Abu Zayd not in the normal working place of a cupper – namely, the hammam or steam bath – but rather in the shop of a drug-and-perfume vendor (*'aṭṭār*), whose stall could be seen in every market. The shelves in the illustrations are filled with items likely to be found in an *'aṭṭār*'s stall: boxes for storing spices and herbs; a mortar and pestle for crushing them to make infusions; a small alembic for making aromatic distillations; and glass vessels like cat. 12, usually resting on the shelf with the rim downwards, the only position in which they are stable on a flat surface.

In this context, these glass vessels might be interpreted as utensils for mixing small quantities of scent or medicaments and transferring them to small perfume or medicine bottles. Indeed they function very well in this capacity, for the opening to the spout is sufficiently close to the rim of the vessel to allow a fair amount of liquid to be held, and possibly mixed, in the vessel without being spilt, while the slender spout would make it useful for filling a very small bottle. If this was their function, as we would like to propose, then the humorous effect of Abu Zayd's trickery is enhanced in illustrations which show him using as a cupping-glass a common utensil which could have been seen by anyone buying perfumes or medicines.

1. London, Science Museum, Wellcome Collection, inv. nos A638596, A638597 and A628791 (unpublished); Washington, DC, Smithsonian Institution, National Museum of American History, Medical Sciences Division, inv. no.207389, cat. no.M-6836 (incorrectly labelled inv. no.224478 M-8037 in the illustration published by Davis & Appel 1979, p.19, fig.9); Stockholm, National Museum (Lamm 1935, pl.15, item A); Cairo, Museum of Islamic Art, inv. nos 71-10-55, 68-12-83 (both unpublished), 66-5-109 (Kubiak & Scanlon 1973, pl.iv-c), 72-10-13 (Scanlon 1981, pl.xiv-d) and one unpublished example with an unknown inventory number.
2. Jerusalem, L.A. Mayer Memorial Institute of Islamic Art, Mayer Memorial G37 (Hasson 1979, p.4, no.1); Stuttgart, Linden-Museum (Kalter 1987, p.11); Washington, DC, Smithsonian Institution, National Museum of American History, inv. no.224,478, cat. no.M-8037 (unpublished); Safar, Kuwait, Dar al-Athar al-Islamiyyah, inv. no.LNS 90G (illustratd in Qaddumi 1987, p.108); present location unknown (Riyadh 1985, p.77, no.58); two examples offered for sale at Sotheby's, London, 10–11 October 1990, lot no.45; one offered for sale at Sotheby's, London, 24–5 April 1991, lot no.828; one offered for sale in Paris (Loudmer & Kevorkian 1985, p.229, no.561); Stockholm, National Museum (Lamm 1935, pl.15, item C); Cairo, Museum of Islamic Art, inv. no.78-11-6 (Scanlon 1984, p.29, fig.46); and Pittsburgh, Carnegie Museum, inv. no.22653/1 (Bergman & Oliver 1980, p.142, item 246, where references are given to four additional examples on which the angle of the stem is not known).
3. London, Science Museum, inv. nos A638598, A72847, A120930 and A72847 (unpublished); Stockholm, National Museum (illustrated in Lamm 1935, pl.5, item B; Lamm 1929, II, pl.1, no.16 and pl.2, nos. 13 and 14; Lane 1937, p.63, fig.10, item T; Cairo, Museum of Islamic Art, inv. nos 73-9-18 (unpublished) and 78-10-41 (Scanlon 1984, p.25, fig.40) and one of unknown inventory number (Kubiak & Scanlon 1980, fig.9-a); and Athens, Benaki Museum, inv. no.41/30 (Clairmont 1977, pl.23, no.387, with references to additional examples).
4. Stockholm, National Museum (Lamm 1935, pl.15, item D and pl.1, item D).
5. Kalter 1987, p.11; and Loudmer & Kevorkian 1985, p.229.
6. Lamm 1929, II, pl.2, nos 13 and 14, both with straight stems and an estimated date *circa* AD 900.
7. New York, Metropolitan Museum of Art, inv. no.38.40.195 (Bergman & Oliver 1980, p.142); Washington, DC, Smithsonian Institution, Museum of American History, inv. no.207,389, cat. no.M-6836 said to have been found at Nishapur (Davis & Appel 1979, p.19 with incorrect refence nos); Jerusalem, L.A. Mayer Memorial Institute of Islamic Art, Mayer Memorial G37 (Hasson 1979, pp.4–5).
8. Lamm 1935, pl.15, items A, B, C and D.
9. For those found in great quantites at Al-Mina in northern Syria, see Lane 1937. One example, with a straight stem, is illustrated.
10. Two have very straight stems (Cairo, Museum of Islamic Art, inv. nos 73-9-18 (unpublished) and 78-10-41 (Scanlon 1984, p.25, fig.40), dated respectively *circa* AD 900 and *circa* AD 1000. One, with a narrow bowl and a stem curving gently away from the rim, is in Cairo, Museum of Islamic Art, inv. no.78-11-6, dated to the 11th century (Scanlon 1984, p.29, fig.46). The remaining finds are so fragmentary that the direction of the curve of the stem is not evident. Three are unpublished: Cairo Museum of Islamic Art, inv. nos 71-10-55 (*circa* AD 800), 68-12-83 (*circa* AD 1000), and one *circa* AD 800. Of two others, inv. no.66-5-109, of the 8th or 9th century, has an unusually elongated bowl, and inv. no.72-10-13 is dated to the 9th century (Kubiak & Scanlon 1973, pl.iv.c and Scanlon 1981, pl.xiv.d). Information regarding the objects was kindly supplied by George Scanlon. All eight will be illustrated as fig.29a–h in the final report of the Fustat Expedition. Lamm (1929, II, pl.1, no.16) illustrates another, also with a straight stem, found in Egypt.
11. These small, wheel-cut perfume bottles derive the name 'molar' flasks from the four legs on which they stand. They have been excavated in large numbers at Samarra and have been found in numerous other sites. They are generally assigned to the period spanning the 8th to the 10th centuries. See Hasson 1979, pp.27, 28; and Clairmont 1977, pp.91–3, for references to other studies.
12. A considerable number of objects rather similar in shape but made of sheet metal survive: for example, London, Science Museum, Wellcome Collection, inv. nos A640535, A640536, A640537, A640538, A640539, A640540, A640541, A640542, A640543, A640544 (unpublished). They are thought to come from North Africa and to be of fairly recent manufacture, although no specific information is available on their provenance. They all have a cloth wrapping at the end of the curved, tapering tube, as if to protect the mouth from the hot metal. Their purpose is uncertain, but perhaps they represent a continuation of one of the functions of the early Islamic glass vessels.
13. This identification was advocated by, among others, Lamm 1935, pl.15; Clairmont 1977, p.111; Davis & Appel 1979, p.19; Scanlon 1981, pl.xiv.d; 1984, pp.25 and 29; Kubiak & Scanlon 1980, fig.9a; and 1993, pl.iv.c.
14. Zahrawi, pp.358–61 and 656–73.
15. For Roman and Byzantine cupping-vessels, see Jackson 1994, pp.182–4 and fig.3,12; Milne 1907, pp.101–3 and pls XXXII–XXXV.
16. Ryding 1994.
17. See note 4, above.
18. For illustrations see Milne 1907, pl.XXXVI, and Alpinus 1719, pp.139–41 and two plates between pp.140 and 141. Alpino also mentioned cupping devices made of horn; mouth suction was used to extract the air and then the vessel was sealed with a piece of moistened parchment. This type of device was described in the 1st

century AD by the Roman writer Celsus, briefly mentioned by al-Zahrawi in the 10th century, and was still being used in parts of Africa and India well into the 20th century: see Jackson 1994, p.183; Milne 1907, p.104 and pl.XXXVII; Alpinus 1719, plate between pp.138 and 139; Mapleson 1830, p.25; and Davis & Appel 1979, pp.18–19. A number of horn cupping-vessels exist today in museum collections, for example, London, Science Museum, Wellcome Collection, inv. no.A6066. Earthenware cupping-vessels of traditional design, with no tube or apparatus for suction by mouth and heated using hot embers, were still being used recently in Libya (Jurányi 1988, p.100 and illustration on p.102).
19. Such uses have been suggested by Hasson 1979, p.5; Bergman & Oliver 1980, p.142; and Allan 1976, I, p.348.
20. The inventories of the Science Museum, London, describe all seven of their examples as breast relievers or, possibly, alembics; for breast-cupping, see Davis & Appel 1979, pp.32–4.
21. Hariri–Baqa'i, pp.384–96; for an English translation, see Hariri–Steingass, II, pp.156–62 and 290–95.
22. See Brunschvig 1962; and Beg 1982.
23. In the text, the location is referred to as the cupper's *mawsim* and is mentioned with his *mīsam*, both words being derived from the same root. In this context, the cupper's *mawsim* is his place of meeting and his *mīsam* could be either a mark of beauty or a mark made by a cautery iron, or even the cautery iron itself.
24. Paris, Bibliothèque Nationale, MS.arabe 5847. This manuscript has three illustrations of the scene, the most detailed being that on folio 154b; see Grabar 1984, fiche 9C7. On folio 156a, a second illustration shows four rather large hemispherical objects with curved stems standing on the shelves. The cupper is addressing the audience; Grabar 1984, fiche 9C9. The third version on folio 155b is too damaged to make out details; Grabar 1984, fiche 9C8.
25. Leningrad, Academy of Sciences, MS.S.23, p.328, the most detailed of three illustrations of the scene: Grabar 1984, fiche 9C10; Hasson 1979, p.4, fig.2; and Davis & Appel 1979, p.77, fig.59. A very similar illustration on p.331 includes two of the glass utensils (Grabar 1984, fiche 9C11), while on p.333 the act of cupping is not shown although two bell-shaped glass instruments and other equipment are illustrated (Grabar 1984, fiche 9C12).
26. London, British Library, MS.Or. add. 22114, folio 51a, of the early 14th century; Grabar 1984, fiche 9D6.
27. Istanbul, Süleymaniye Library, MS.Esad Efendi 2961, folio 198a, of the 13th century; the figures are damaged but the equipment is identifiable – see Grabar 1984, fiche 9D1.
28. Paris, Bibliothèque Nationale, MS.arabe 6094, folio174a (Grabar 1984, fiche 9C6); Oxford, Bodleian Library, MS.Marsh 158, folio120a (Grabar 1984, fiche 9D9). The latter has the illustration of two blue glass vessels.

Glass alchemical equipment

by Emilie Savage-Smith

In the Islamic lands, many of the techniques employed in drug production were also part of the realm of alchemy. The Arabic word *al-kīmiyā'*, from which we derive the word alchemy, was used for both chemistry and alchemy, and no clear distinction was made between the two activities.[1] A wide range of chemical processes was undertaken by both the druggist and the alchemist, including distillation, calcination, evaporation, crystallization, sublimation, filtration, amalgamation and ceration. Their workshops would be stocked with a large number of vessels, such as alembics and cucurbits (respectively, the head and lower part of the distilling apparatus), receiving vessels, funnels, water-baths, filters, and crucibles, in addition to mortars and pestles for pulverizing substances and braziers and stoves for heating them. With the exception of mortars and pestles, most medieval Islamic chemical equipment was made of glass.

Distillation was one of the most important processes in Islamic chemical technology, being employed for medicinal, technological and industrial purposes, including the preparation of mineral acids and the distillation of perfumes, rose-water and essential oils. The procedure required a boiler, a condenser and a receiver. The boiling vessel was called a *qar'* ('gourd, pumpkin') because of its gourd-like shape.[2] The English term, cucurbit, is from the Latin *cucurbita*, also meaning 'gourd'. The most common type of condenser or still-head was the alembic (*anbīq*) which was separate from the boiling vessel (see cat.13 below). A liquid would be heated to boiling in the cucurbit; the distillate or condensed vapour would form on the inside of the dome of the alembic and run down into the rim or internal gutter formed by the collar, then pass out through the long delivery tube into an attached receiving vessel (*muqābalah*); see fig.3.

The cucurbit might be placed in sand or in a water-bath which could be heated by any one of a variety of furnaces or stoves. Alternatively, the boiling flask could be heated gently by means of a small lamp. Boiling vessels had rounded bottoms so that they could be easily adjusted to any required angle in the sand or water-bath or by being placed in a ring support. Eventually the arrangements of cucurbits, alembics, and receiving tubes reached grand proportions, with multiple still-heads, one on top of another, and circles of cucurbits heated by enormous furnaces with numerous receiving vessels attached to collect the distillates.[3] Receiving flasks could take any number of forms, as long as their bottoms were also rounded and they possessed long, cylindrical necks into which the delivery tube of the alembic could be inserted. Three glass flasks in the Khalili Collection, cat.17–19, have flattened spherical bodies and could well have served such a purpose.[4]

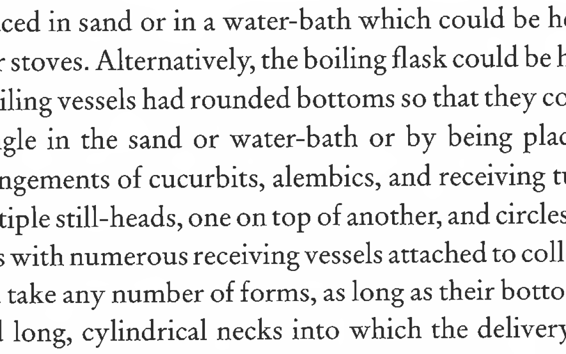


Figure 3 Diagram showing the arrangement of (1) alembic (2) cucurbit (3) sand (4) brick furnace (5) delivery tube and (6) receiving flask.

The origin of the process of distillation is obscure, but there is evidence to suggest that it was practised in Mesopotamia and China, and possibly India, before the advent of Islam.[5] However, the development of the retort (*al-ʿawjā*), in which the condenser and boiler were combined in one unit (see fig. 4), appears to be an Islamic development and is illustrated in many late medieval manuscripts.[6] A retort could only be used with liquids, and filling the vessel through the small aperture at the end of the long, curved delivery tube would have required a very narrow funnel (see cat. 14). Only one medieval Islamic vessel identifiable as a retort has been recorded. It has a bulbous, gourd-shaped body with a long, narrow neck that bends through a right angle.[7] Seven gourd-shaped vessels in the Khalili Collection, cat. 15 and 16, might also be examples of retorts, particularly if one assumes that their necks were originally much longer than they are at present, although they could also have been used as condensers or receiving vessels.

There is no explicit description in medieval Islamic written sources of the method of externally cooling the delivery tube, which is a requirement for the distillation of alcohol. From a number of brief statements, such as that made by al-Kindi in the 9th century, however, it seems probable that some form of water-cooling was occasionally employed to distill wine.[8] A system in which the entire still-head incorporates a cooling bath into its design is commonly known as a 'moor's-head' still. Its earliest recorded illustration is a Western drawing of 1485, but when and where the design arose is unknown. Metal 'moor's-head' or cold stills are illustrated in a number of 17th- and 18th-century Arabic and Turkish

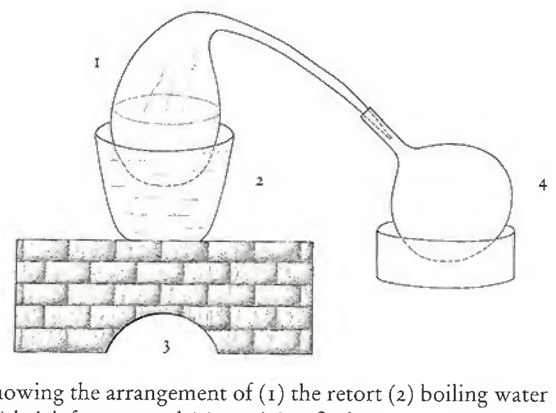


Figure 4 Diagram showing the arrangement of (1) the retort (2) boiling water (3) brick furnace and (4) receiving flask.

manuscripts on alchemy or chemical medicine,[9] and in Algeria and Morocco they are still in use for preparing rose-water.[10]

Another basic piece of chemical or medical equipment was a funnel (*qimʿ*), which eased the transfer of substances from a larger to a smaller container. Few funnels are described in the published scholarly literature, although several, often fragmentary, are preserved in various collections. The Science Museum in London has six Islamic glass funnels of rather different shape, and possibly of an earlier date, to that in the Khalili Collection, cat. 14, an Iranian piece of the 18th or 19th century. One of these has a cylindrical body with a moulded upper rim and a lower narrow curved spout.[11] The other five funnels are all shaped like a tobacco pipe, with a conical upright bowl at right angles to an apparently straight, tapering stem. On all five examples, however, the stems are broken so that their original lengths are unknown.[12]

Because alchemical equipment has been considered of little artistic value, it is not normally found among museum collections, or, if it is represented, it tends to be neglected.

Such equipment, moreover, is not readily identified by cataloguers at auction houses. An Islamic alembic, for example, which was recently acquired by the Science Museum in London, was described in the sale catalogue (where it was illustrated upside down) as 'a fine and rare Roman glass funerary vessel'.[13] The fragility of glass utensils and the frequent corrosion of their surfaces from the impurities and acidic substances placed in them must have resulted in most items being destroyed after use. It is the items that remained unused – perhaps because of flaws in construction, as evidenced by cat.13 opposite – that tend to be preserved. Furthermore, it is difficult to evaluate the age and origin of alchemical equipment because there is little information on the provenance of the known objects. Until further information regarding medieval alembics, cucurbits, and receiving vessels is collected, and a typology of forms developed, any attempts to date or locate individual objects can only be tentative, and little can be said regarding development in the design and production of Islamic chemical equipment.

1. See Newman 1985; Ullmann 1986; Hill 1990; and Hill 1993, pp.76–91.
2. For an example in the Science Museum, London, see Hassan & Hill 1986, p.134, fig.6.2.
3. For a list of alchemical equipment according to the 9th-century physician al-Razi, see Hassan & Hill 1986, pp.134–5; for manuscript illustrations of distilling apparatus and other alchemical equipment, see Sari 1986; Sari & Zülfikar 1992; Savage-Smith 1993, p.238, and 1994, p.20.
4. Alternatively, they may be versions of those objects usually referred to as 'pilgrim flasks', and in form they are clearly related to some Byzantine glass vessels.
5. See Levey 1955; Levey 1960; and Ping-Yü & Needham 1959.
6. For examples, see Sari 1986, pp.62, 68–70 and 73.
7. National Museum, Damascus; see al-Ush, Joundhi & Zoudhi, no date, p.250 and illustration no.113. The vessel's provenance is unknown, but it has been attributed to the 10th century. The diameter of the body is 9.6 centimetres, and the maximum width across the whole object, including the neck, is 22.2 centimetres.
8. See the examples cited by Hill (1993, p.85).
9. For examples, see Savage-Smith 1993, p.238 (lower-left corner); and Sari 1986, p.56.
10. See Goodfield & Toulmin 1964; Hassan & Hill 1986, pp.139–40; and Ping-Yü & Needham 1959, pp.107–8. The Science Museum, London, has a number of large metal 'moor's-head' stills from the Middle East, for example, those in the Wellcome Collection, inv. nos A631293 and A631294.
11. Science Museum, London, Wellcome Collection, inv. no.A79582, of green iridescent glass, 17.2 centimetres long and 4.3 centimetres in diameter. The lower curved end is broken.
12. Science Museum, London, Wellcome Collection, inv. nos A79640, A79571, A638600, and A6073, of amber or green glass. The height of the bowls ranges from 4.5 to 6 centimetres and the present length of the stems from 9.5 to 11 centimetres. Inv. no.A628427, of blue glass, is of the same shape, with a bowl 6 centimetres high and a stem 23.5 centimetres long.
13. See Anderson 1983, p.822.

13

Glass alembic

Iran, 9th–10th century

Translucent green-brown glass with patches of iridescence and a dark weathering crust
height 13.5 cm *diameter of rim* 7.7 cm
diameter of body 13.6 cm
length of delivery tube 8.8 cm
diameter of tip of tube 1 cm
inner diameter of tube 0.7 cm
width 21.3 cm (including spout)
accession no. GLS 199

The alembic has a cup-shaped body with an the indented top where the pontil mark is located. A cylindrical collar forms the lower part of the alembic. A tapered delivery tube, only part of which remains intact, protrudes at a right angle from the body. It is set so far up the side of the body, however, that the distillate accumulating in the internal gutter could not easily drain off. As a result, the alembic would not have functioned properly, and it may have been discarded as a piece of ineffectual equipment.

A similar alembic with a delivery tube at an equally sharp right angle, but set lower down the body and closer to the internal gutter formed by the collar, presumably found at Rayy, has been assigned to the 9th or 10th century.[1] An alembic considered to be of Islamic origin of the 10th to 12th century is one of four Islamic distillation utensils recently acquired by the Science Museum in London.[2] This has a more flattened body than the alembic in the Khalili Collection, and its delivery tube angles downwards from the shoulder of the body so that the internal gutter could be effectively drained.

Three other glass alembics are recorded that have the delivery tube attached to the body at the shoulder and angling sharply downwards, but they have a knob at the top of the body instead of a depression. They have been associated with Egypt and considered either pre-Islamic of about the 6th century AD, or early Islamic of about the 8th century.[3] No alembics are recorded as coming from reliably dated contexts.

1. Lamm 1935, pl.15, 1 and photograph on pl.2B. See also the catalogues of sales at Sotheby's, London, 11 October 1989, lot no.27 and 13 April 1988, lot no.251.
2. Science Museum, London, inv. no.1978.219.220, unprovenanced; see Anderson 1983; and Cossons 1992, p.19. Other, unpublished, Islamic glass alembics are in the Royal Ontario Museum, Toronto, and the Medelhavsmuseet, Stockholm.
3. See Clairmont 1977, pp.110–11, item 386 and pl.XXIII; Lamm 1929, II, pp.28–9 and pl.1, no.17; and Hassan & Hill 1986, p.135, for a photograph of one in the Victoria & Albert Museum, London, which also has a 19th-century green glass alembic and cucurbit from Patna, India, inv. no.3130 I.S. 1883. The Science Museum, London, has a modern Persian alembic and cucurbit acquired in 1975 from an alchemist in Iran (inv. no.1977.293). For photographs of modern Iranian alembics and alchemical equipment, see Nasr 1976, pp.203 and 205.

14

14

Funnel

Iran, 18th–19th century

Green-brown free-blown glass
length 42.5 cm *diameter of rim* 10.3 cm
diameter of tip of spout 0.9 cm
inner diameter of tip 0.6 cm
accession no. GLS 324

The funnel has a long, tapering spout, curved at the narrow end. At the wide end there is a broad, flattened rim. Indentations can be seen on the neck of the funnel where the glassblower clasped the wide end with a pair of tongs or similar tool.

The utensil has survived intact, despite its extreme fragility. It displays few signs of use, particularly with any acidic substance. Such a long, thin shape would permit the easy transfer of liquids from a larger to a much smaller container.

A similar funnel is said to have been made in Shiraz in the 18th or 19th century.[1]

1. See the catalogue of a sale at Sotheby's, London, 21–22 April 1980, lot no.357.

15, 16

Glass vessel, perhaps for alchemical use

Provenance unknown

Dark-blue, free-blown soda-lime glass, with slight iridescence
height 24.5 cm *diameter of neck* 1.1 cm (outer) 0.7 cm (inner)
maximum diameter 6.8 cm
accession no. GLS 254

Six glass vessels, perhaps for alchemical use

Provenance unknown

Dark-blue, free-blown soda-lime glass, with slight iridescence

height 16.6 cm *diameter of neck* 1.2 cm (outer) 0.8 cm (inner)
maximum diameter 9.1 cm
accession no. GLS 252.1

height 16.2 cm *diameter of neck* 1.2 cm (outer) 0.9 cm (inner)
maximum diameter 8.4 cm
accession no. GLS 252.2

height 16.2 cm *diameter of neck* 1.2 cm (outer) 0.9 cm (inner)
maximum diameter 9.1 cm
accession no. GLS 252.3

height 16.7 cm *diameter of neck* 1.2 cm (outer) 0.9 cm (inner)
maximum diameter 8.8 cm
accession no. GLS 252.4

height 16.9 cm *diameter of neck* 1.2 cm (outer) 0.8 cm (inner)
maximum diameter 9.2 cm
accession no. GLS 252.5

height 16.2 cm *diameter of neck* 1.2 cm (outer) 0.8 cm (inner)
maximum diameter 9.5 cm
accession no. GLS 252.6

These seven gourd-shaped vessels are all of dark-blue, soda-lime glass, and are of a type especially associated with Iran, though their distribution appears to have been wider. The inner and outer surfaces are as glossy as when newly made, with no signs of corrosion. This puzzling feature can also be observed on larger vessels of the same form as cat.15[1] excavated at a 9th- and 10th-century site in Nishapur, and on one of more spherical shape that was found with five other Islamic glass vessels, all apparently imported by sea, in a Northern Song pagoda in Dingxian, in the Hebei province of China, dated AD 976.[2] A fragment consisting of the neck and shoulders of another is now in Baghdad, and there are a number of unprovenanced examples.[3]

Were it not for the securely dated archaeological sites at which some of these examples have been excavated, their almost pristine surface condition might give rise to doubt about the dating. The lack of corrosion suggests that they were not used repeatedly, and it may be that such vessels were generally employed no more than once before disposal, in which case all the preserved ones are unused. Their export to China implies that either the vessels themselves were considered of sufficient value to warrant their being shipped empty, or that they were designed to contain a particularly valuable substance which left no trace on the interior surface. The consistent form, even of those shipped great distances, certainly suggests a deliberate design and function.

The rims of the very narrow necks of all recorded examples appear to have been sheared off at the time of production, as here, but what this implies about their intended use is unclear. Such evidence might suggest that the present length of the necks is the intended final length, in which case the flasks may have served as condensing vessels or receiving bottles attached to the delivery tube of an alembic during distillation. Spherical condensers with short but thin necks are occasionally illustrated in 18th-century Persian and Turkish alchemical manuscripts.[4] It is also possible, given the narrowness of the openings, that they could have served as a form of retort – that is, a boiling vessel that allowed steam to pass into another container via a long, narrow neck curving downwards. Had the necks originally been longer than at present, the vessels might also have been used for distilling essences in the same way as spheroid glass vessels with extraordinarily long, thin necks that are designated for that purpose and illustrated in manuscripts.[5]

Whatever their function, the distinctive gourd-like shape of all the vessels is typical of alchemical equipment in general, the curved bottoms allowing them to be positioned at any angle required by the chemical process, and they could easily have served as receiving vessels for distillates of essential oils.[6]

15

1. The form of the larger vessel is reminiscent of two late Roman elongated tubular glass flagons assigned to the Eastern Mediterranean of the 3rd or 4th century and now in the Yale University Art Gallery, CT, Mansfield Collection, inv. nos 1930.386 and 1930.387 (40.4 and 37.7 centimetres long respectively); Matheson 1980, pp.86–8.

2. For the vessels from Nishapur, see Auth 1976, p.166; Hasson 1979, p.5, item 3, for an illustration of one now in the L.A. Mayer Memorial Museum, Jerusalem, inv. no.G37; and Jiayao 1987, p.10, fig.22. For the Dingzian find, see Jiayao 1987, pp.11, 47 and fig.21 (on p.10); and Jiayao 1991, p.7 and fig.8 (on p.12). An x-ray analysis indicated that the Dingzian find is of soda-lime glass with a certain amount of potassium.

3. Abdul-Khaliq 1976, p.292, pl.11, item 3; and the catalogue of a sale at Christie's, London, 19–21 October 1993, lot no.321; present location unknown.

4. For an illustration of a round condenser (*mudawwar muqābilah*) in an 18th-century Turkish manuscript, see Sari 1986, p.59 (lower right).

5. See Sari 1986, p.60 (lower left) for an illustration of three such vessels from an 18th-century Turkish manuscript. For a woodcut showing a European alchemical vessel of similar shape, see Ferrara 1598, p.92.

6. This shape is strikingly similar to that of the cylindrical pottery objects with short stems at one end that were found at Samarra, under pavements in buildings constructed during the reign of al-Muʿtasim (AD 833–842) and in disuse by the end of al-Mutawakkil's reign (AH 245/AD 859). However, the pottery vessels are much larger (20 centimetres in diameter and 80–85 centimetres in length) and had a removable cap at the rounded end; they were also covered with bitumen and often painted with portraits and appear to have been made to contain different types of wine. See Rice 1958.

16; GLS252.1–3 (top), GLS252.4–6 (bottom)

17–19

Three receiving flasks or condensing bottles

Provenance unknown

Translucent amber or green free-blown glass, with evident iridescence and white, calcium-like deposits

height 16.8 cm *width* 9 cm
thickness of body 0.8 cm (at neck)
0.7 cm (at bottom)
diameter of neck 1.7 cm (outer)
1.5 cm (inner)
accession no. GLS 374

height 18.6 cm *width* 12.6 cm
thickness of body 1.4 cm (at neck)
0.6 cm (at bottom)
diameter of neck 2 cm (outer)
1.8 cm (inner)
accession no. GLS 375

height 20 cm *width* 13 cm
thickness of body 1.5 cm (at neck)
0.6 cm (thinnest part of side)
diameter of neck 2.3 cm (outer)
1.8 cm (inner)
accession no. GLS 376

The flattened, spherical bodies of these three flasks are coplanar with the cylindrical necks, which rise abruptly from the shoulders of the vessels. All the necks are broken, so that their original lengths are unknown.

The supposition that their necks were originally longer suggests that the flasks were receiving vessels or condensing bottles, to be attached to the delivery tube of an alembic. The circular form of the bodies is such that the vessels cannot stand by themselves, but when in use they could have been set in a ring-support or in sand and adjusted to an appropriate angle. Their flattened sides would allow for easy storage or shipment of the distillate if required.[1]

The dates of such items are uncertain, possibly ranging from the 10th to the 14th centuries, and nothing is known of their place of production. Little attention has been given them, even though a considerable number appear to be preserved, most without provenance. In the Science Museum in London, for example, there are 14 flasks of comparable shape and size, all with their cylindrical necks now broken.[2]

The forms of both the bodies and the necks are also reminiscent of those on Roman glass 'pilgrim flasks' of the Eastern Mediterranean attributable to the 2nd century AD, except that the necks on the Roman pieces are slightly shorter in proportion to the body, and they all have finished rims, usually everted or rolled.[3]

1. For a different interpretation of these vessels, see Goldstein forthcoming.
2. Science Museum, London, Wellcome Collection, inv. nos A120947, A120948, A120950, A120952, A120957, A120958, A240588–240590, A628063, A628064, A628075, A628081 and A628695, with heights varying from 12 to 21 centimetres and widths from 7.7 to 14 centimetres. Most are quite iridescent and encrusted with deposits. The Science Museum also has 11 much smaller glass flasks with flattened spherical bodies, varying in width from 2.6 to 3 centimetres and in height from 5 to 6 centimetres. The rims on three of the small ones are preserved intact, and all show little iridescence and almost no deposits on the surfaces. It would seem that the smaller vessels served quite a different function from the larger ones, probably as phials holding small quantities of essential oils.
3. For examples, see Loudmer & Kevorkian 1985, pp. 102–3.

17; GLS 376 (top left), GLS 375 (top right), GLS 374 (bottom)

بسم الله الرحمن الرحیم

محمد علی فاطمه
حسن حسین علی محمد
جعفر موسی علی محمد
علی حسن مهدی

در بیان انکه هر ماهی بچیزی باید نظر کنند

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
محرم	[illegible]	[illegible]	[illegible]	فرزند	سوره [illegible]
صفر	[illegible]	[illegible]	[illegible]	[illegible]	سوره الشوری
ربیع الاول	[illegible]	[illegible]	[illegible]	[illegible]	سوره [illegible]
ربیع الآخر	[illegible]	[illegible]	علم	ابر و [illegible]	سوره الملک
جمادی الاول	[illegible]	آب	[illegible]	[illegible]	سوره [illegible]
جمادی الآخر	[illegible]	[illegible]	[illegible]	[illegible]	سوره [illegible]
رجب	[illegible]	[illegible]	مصحف	[illegible]	سوره [illegible]
شعبان	[illegible]	عود	گل	علما و [illegible]	سوره ص
رمضان	مصحف	مصحف	شمشیر	[illegible]	سوره [illegible]
شوال	[illegible]	[illegible]	[illegible]	[illegible]	سوره الکهف
ذی القعده	[illegible]	[illegible]	[illegible]	آینه شمشیر	سوره النساء
ذی الحجه	[illegible]	[illegible]	[illegible]	[illegible]	سوره الکهف

هر که باین شکل نکرد بجوسی نکند

باین تکسیر حمد نظر کنند

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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هر که باین شکل کند شهید باشد

باین تکسیر توحید نظر کنند

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

هر که بدین شکل نکرد در انجا بیمار نشود

لا	اله	الا	الله	محمد
رسول	الله	لایح	لاء	۶۲
۲۲	۷۳	۳۷۳	۲۷۳	۷۲
۲۲	۷۳	۳۷۳	۷۸	۷۲
۸۸	۲۲۷۱	۲۸۱	۲۷	۷۷

بسم الله الرحمن الرحیم ### هلاله

مدسوع اسب

باین شکل نکرد بیمار و رنجور نشود

لا اله	الا الله	محمد	رسول الله
لا اله	الا الله	۱۲۳ ۱۲	۱۱۱

در هر برج بچیزی باید نظر نمود

حمل	سلاح مصقول
ثور	گیاه سبز یا مروارید
جوزا	روی جوانان
سرطان	گوسفند یا آب روان
اسد	انگشتری
سنبله	آینه روشن
میزان	آینه روشن
عقرب	سلاح یا آب صاف
قوس	جامه سرخ یا آتش
جدی	روی زهاد و علما
دلو	روی شیخ
حوت	نامه و دفتر

در وقت دیدن هلال این کلمات بخوانند

لا اله الا الله موسی کلیم الله	لا اله الا الله ابرهیم خلیل الله
لا اله الا الله عیسی روح الله	لا اله الا الله محمد حبیب الله

در وقت دیدن هلال نظر کنند

ملح	ملح	ملح
هلح	هلح	هلح
هلح	هلح	هلح

ه۱۱۱ م ۱۱۱۱ ۶

از حضرت [illegible] لسیک و [illegible] هلال [illegible]

۱	یا الله	یا رحمن	یا رحیم	یا کریم
۱	یا قادر	۱۵۱۳	یا الله	۹۹۹ه
۱	یا حی	کوک	محمد ۹۹ء	۵۵ هه
۱	۱۱۱۱ ۸۸۱	۱۱۲۱۱۶۸۷۱۲	۱۱۲۴/۹۹/۱۵	۲۲۲ گ

هیج مرع و مم هیج

سو ۹ ۱۳	هه ۵ ۵	لا ۲۲۲ ۱۱
یا الله سو	محمد ۲۹۹	
۱۳ ۵ ۹	کوک	۱۱۲۱ ۸۱۸۲

Magic and Islam

by Emilie Savage-Smith

Composite talismanic chart
Iran, 19th century

One of 8 folios, 50.1 × 31.5 cm, of a thin, highly burnished paper with fine laid lines but no visible chain lines, the edges ruled in gold and black; text area 22.3 × 36.8 cm framed by black, gold, green, red and blue lines; text in *naskh* and *riqā'* scripts in red and black inks within panels defined and subdivided by gold and black lines
accession no. MSS 412, folio 1b
(see cat.106)

This talismanic chart occurs on the first folio of a carefully executed, large-format manuscript which, although undated and anonymous, was evidently produced for use in the Twelver or Imami Shi'i community in Iran.[1]

The chart is composed of several charts and talismans to be employed at different times and occasions, arranged in three columns, with the title for the entire chart written at the top of the central column: 'Whoever looks at this chart will be a witness to it', that is, he will be able to testify to its efficacy.

In the main right-hand column, under the *basmalah*, there is a square containing the names of the holy family and the Imams recognized by the Twelver Shi'i community, Muhammad, 'Ali, Fatimah, Hasan, Husayn, 'Ali [Zayn al-'Abidin], Muhammad [al-Baqir], Ja'far [al-Sadiq], Musa [al-Kazim], 'Ali [al-Rida], Muhammad [al-Taqi], 'Ali [al-Naqi], Hasan [al-'Askari] and [Muhammad] Mahdi. Beneath these names is a chart arranged in six columns and entitled 'For the explanation that each month it is necessary to look at something'. The right-hand column contains the names of the twelve months and the left-hand column assigns the name of a Qur'anic surah to each month. The four inner columns list items to be viewed monthly according to the opinion of various authorities. For example, in the second month, Safar, one should look at gold and silver according to the Imam Ja'far al-Sadiq (second column from the right), or a mirror according to Nasir al-Din al-Tusi (third column) and other authorities (*akābir*, 'powerful people') or one's own hand according to yet other authorities (*ḥukamā'*, 'wise people', fifth column).

Although they portrayed magical symbols whose imagery might be traceable to pre-Islamic traditions, the amulets and talismanic objects used by Muslims chiefly took the form of pious invocations to God, through Qur'anic quotations and prayers displaying a constant trust in Him. In this respect, Islamic magical practices differ substantially from Byzantine, Roman, early Iranian and other pre-Islamic magic.[1]

Amongst the Qur'anic verses on the magical items in the Khalili Collection, the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255) predominates. The last two surahs of the Qur'an, *al-Falaq* and *al-Nās* (CXIII and CXIV), known collectively as *al-Mu'awwidhatān* ('those of Seeking Refuge [from evil practices]') are also frequently employed, especially on items made for the Shi'i community. So too is the surah *al-Kāfirūn* (CIX), which emphasizes that the user does not worship what unbelievers do. Table 1 presents a list of all the Qur'anic passages occurring on the magical artefacts catalogued here, and indicates which are used on Shi'i objects.

Most magic in the Islamic world was protective in nature, asking for God's general beneficence. Occasionally, His intervention against other powers – the evil eye, assorted demons (*shayāṭīn*) and the *jinn*, 'shape-shifting' supernatural creatures whose existence was recognized in the Qur'an[2] – was specifically sought. This underlying assumption of the existence of evil beings was inherited from pre-Islamic societies, as were many of the methods of counteracting them.

Such recognition of active supernatural forces other than God's to a certain extent contradicted the strict monotheism of Islam, though not the omnipotence of God, to Whom were directed all pleas for intervention. Clerics recognized as legitimate those forms of magic that appealed only to God, but not the illicit forms addressed to *jinn* and demons. Manuals of Prophetic medicine, advocating the traditional medical practices of the Prophet Muhammad's day and those mentioned in the Qur'an, were composed by clerics who expounded largely magical and folkloric approaches to maintaining health and well-being, as in cat.11.[3] It was also considered acceptable to address such invocations to angels, to Muhammad, to 'Ali (if one was a Shi'i) or other members of the holy family, and to saints: all these were believed to intercede with God on behalf of the supplicant.[4]

The prayers, Qur'anic verses and invocations employing the 99 *asmā' al-ḥusnā* ('Beautiful Names of God') applied to magical objects were supplemented by an array of symbols whose function was to strengthen the supplications. Many of these magical symbols were inherited from earlier cultures, and their origins and significance have become obscured with the passage of time. For example, a long-horned stag or oryx appears on very early amulets (see pp.135–7) but disappears as a magical symbol on objects made in subsequent centuries. Pre-Islamic magical imagery featuring lions, serpents and scorpions can be seen on several types of artefact, such as amulets and magic-medicinal bowls. The representation of the human hand played an important role in protection against the evil eye throughout the pre-Islamic Middle East and continued to do so in the Islamic lands, as seen on cat.85–7.[5] Astrological iconography derived from classical antiquity, involving emblematic representations of the twelve zodiacal signs and the seven classical planets, also played a role in talismanic design. It is displayed, for example, on some amulets, mirrors and magic-medicinal bowls (see, for example, cat.29).[6]

Magic writing, composed of numerals and letters as well as other marks, is another common feature, including a type of ancient magic symbol consisting of combinations of short lines ending in tight curls, often called lunette sigla.[7] A magical design might also include pseudo-writing – that is, inscriptions, often in a script resembling Kufic, that are

Beneath this chart a large label reads, 'Whoever looks at this diagram will avert misfortune' and there is a 15 × 15 verse square labelled 'Let him look at the arrangement of the laudation', a reference to the formula *al-ḥamdu lillāh* ('Praise be to God.') The square contains the entire text of the first surah of the Qur'an, which begins with this formula.

In the central column, beneath the main title, a 10 × 10 verse square contains the entire text of the surah *al-Ikhlāṣ* (CXII) and is labelled 'Let him look at this arrangement of the *tawḥīd*', the profession of the unity of God. Beneath this verse square there is a 5 × 5 square with the title 'Whoever looks at this diagram will not become ill during this month.' The cells of the square are filled with the *shahādah* and a series of letters and numerals whose significance is not known. A very similar 4 × 4 square is drawn at the bottom of the same column. Between these two squares, a talismanic design consisting mostly of magic letters and symbols is drawn in two more, concentric squares. Incorporated into the border of the design is a label reading, '[Whoever] looks at this diagram will not become ill and infirm.' It would seem that all three squares were to be contemplated in order to gain protection from illness.

The left-hand column begins with a two-column chart entitled 'For each zodiacal sign you must look at something.' The names of the twelve zodiacal signs appear in the right-hand section of the chart and objects associated with them in the left-hand section: for example, a finger ring is paired with Leo.

The remaining four talismanic diagrams in this column are all to be used on first seeing the new moon. The first diagram has four cells, each containing the statement 'There is no god but God' and the name of a prophet, either Moses, Abraham, Jesus or Muhammad. The title of the diagram instructs the user to 'Read these words when seeing the new moon.' The second diagram consists of magic symbols and letters and, at the bottom, the Seven Seals of Solomon. It is labelled 'Look [at this diagram] when seeing the new moon.' Above the third diagram is the statement 'It is reported of the Prophet that [he said]

unintelligible. The origin of this practice is puzzling, though it is possible that it arose over time as amulet-makers copied exemplars that they did not understand. In some cases the maker, as well as the person purchasing the item, may have been virtually illiterate and unable to understand the original inscription or recognize that the copy was meaningless. The question then arises, if a legible inscription is copied in a form that is meaningless, does it still retain for the believer its magical or invocatory power?[8]

From the 13th century onwards, magic and Latin squares became extremely popular motifs, and they are found on every type of magical artefact represented in the Khalili Collection.[9] The five-pointed star or pentagram (sometimes replaced by a hexagram) was known as the 'Seal of Solomon' in the pre-Islamic Near East, and in Islamic magical practices it was combined with six other magical marks to form a logogram of seven symbols representing the name of God. This sigla of the Holy Name (sometimes incorrectly called 'the Seven Seals of Solomon' or 'the Seven Solomonic Seals') was frequently employed from about the 12th century onwards, but does not seem to have been used on early items.[10]

On magical artefacts (at least, on those made of durable materials), the supplications for protection and cure seem to be directed exclusively to God, with an occasional mention of angels.[11] Supplications to darker, demonic forces rarely occur on the type of talismanic material that is catalogued here, although they are mentioned in manuals on magic, and occasionally occur on paper or parchment talismans. In illicit magic, conjurors and sorcerers would address their pleas directly to *jinn* and demons. 'Binding spells' were employed to place others under the direct influence of the magician or his client. Release from such spells is one of the stated uses of early magic-medicinal bowls, and exorcisms of demonic forces were occasionally conducted.[12]

From the 12th century onwards, manuals on magical formulas and procedures proliferated. The acknowledged master of the art was Abu'l-'Abbas Ahmad ibn 'Ali ibn Yusuf al-Buni al-Qurashi (d. 1225), whose work is represented in the Khalili Collection by copies of his most popular manual, cat.20, and of his treatise on the construction of magic squares and on talismanic designs based on the letters composing the *asmā' al-ḥusnā*, cat.22. Subsequent manuals, such as those by 'Abd al-Rahman al-Bistami (see cat.21), further elaborated the already intricate procedures advocated by al-Buni.

Interest in magical healing during the 11th and 12th centuries must have been substantial in Egypt and Syria, for it was apparently at that time that the production of metal magic-medicinal bowls began. The earliest such bowls recorded were made in Syria in the 12th century for Nur al-Din ibn Zangi; the Khalili Collection has an important example of the type, cat.25. Another style of magic-medicinal bowl, with schematic engravings of the Ka'bah, is associated with the name of Saladin (*reg.* 1169–1193), though none of the known examples can be confirmed as having belonged to him. Saladin's name was associated in the popular mind with other magical items, such as an amulet known in Europe as the 'Lee-penny', which was obtained during a Crusade by Sir Simon Lockhart and long preserved by his descendants. It was the source for a 19th-century novel by Sir Walter Scott, *The Talisman*, in which Saladin, in the guise of a physician, cures Richard I while he is encamped in the Holy Land during the Crusades.[13]

The magical artefacts in the Khalili Collection include manuscript copies of manuals on magic, household items – such as mirrors and plaques – with talismanic designs, talismanic charts that could be displayed as household amulets or folded and carried on the person, talismanic shirts that could be worn at times of crisis, amuletic jewellery and magic-medicinal bowls. Besides these, many other household items could also be amuletic or talismanic:

when seeing the new moon, read these words.' The words referred to are invocations to God, using four of the *asmā' al-ḥusnā*, and to Muhammad, but most of the diagram is comprised of numerals and magic letters whose pronunciation would be difficult. The final talisman consists only of magic letter-symbols and numerals and is labelled 'When observing [the new moon], look at this diagram.'

1. The content of the rest of the manuscript is discussed in the entry for cat.106, below.

TABLE 1. QUR'ANIC VERSES OCCURRING ON MAGICAL ARTEFACTS

Surah, verse (line)	Items[1]	
	Sunni[2]	Shi'i / 'Alid
I complete	cat.31, 71, 72, 73, 75 and 106 (folio 1b)	
II, verses 1–5	cat.32	
II, verse 153 (l.3)	cat.68	cat.69
II, verse 255 ('Throne Verse')	cat.26, 27, 43, 44, 45, 46, 47, 48, 103 and 104 TLS13, TLS19 and JLY935 (ex-cat.)	cat.31, 35, 36, 37, 49, 57, 58, 85 and 91
II, verses 255–7 (or 258)	cat.29 and 32	cat.30, 40, 41 and 42 POT1270 (ex-cat.)
II, verse 284 (l.4)		cat.31
III, verse 14	cat.94, 97, 98, TLS19 and TLS25 (ex-cat.)	
III, verses 18–19	cat.25	
III, verses 16–19	cat.29	
III, verses 26–27		cat.49
III, verse 29 (l.4)		cat.35
VIII, verse 46 (l.4)		cat.69
IX, verse 33	cat.89, TLSA and TLSB (ex-cat.)	
IX, verses 128–9	cat.44, 54, 96 and 97, TLS25 (ex-cat.)	
X, verse 57	cat.25, 26	
X, verse 81	cat.25	
XII, verse 34	cat.98	
XII, verse 21 (l.7)	cat.68	
XII, verse 64	cat.48 and 104	cat.33, TLS689 (ex-cat.)
XIII, verse 11	cat.25	
XVI, verse 78	cat.25	
XVII, verse 82	cat.25	
XVIII, verse 39 (l.2)		cat.35
XX, verses 17–21	cat.25	
XX, verse 46	cat.25	
XX, verse 135	cat.95	
XXI, verses 69–80	cat.28	
XXI, verse 87 (ll.4–6)	cat.74	cat.35
XXIV, verse 35	cat.48 and 96, TLS13 (ex-cat.)	cat.49
XXV, verse 45	cat.28	
XXVI, verses 78–80	cat.25	
XXXVI complete		cat.34
XXXVI, verses 1–19		cat.30
XXXVI, verse 58		cat.49
XXXVII, verse 75–82	cat.25	
XXXVIII, verse 33	cat.25	
XL, verse 16 (ll.3–4)		cat.85
XL, verses 18–21	cat.25	
XLVIII		cat.49
XLVIII, verse 1	cat.102	cat.49

1. 'Ex-cat.' denotes an object in the Khalili Collection that is not illustrated or fully catalogued in this volume.
2. Items listed under Sunni are those with no overtly Shi'i or 'Alid prayers or invocations.

XLVIII, verses 1–6	cat.27	
XLVIII, verses 1–18	cat.29	cat.34
LI, verse 58	cat.46	
LV, verses 33–34	cat.32	
LVI, verse 79		cat.35
LIX, verse 22	cat.50	cat.57
LXI, verse 13 (l.2)	cat.38 and 101	cat.30, 35, 49 and 86 TLS689 (ex-cat.)
LXI, verse 13 (ll.2–3)		cat.33
LXV, verses 2–3	TLS13 (ex-cat.)	
LXV, verse 3 (l.2)		cat.35
LXVIII, verses 51–52	cat.48 and 90	cat.31
LXXXI, verses 14–20	cat.25	
LXXXIV, verses 1–4	cat.25 and 28	
XCVII, verses 1–5	cat.39, 99 and 100, TLS13 (ex-cat.)	
XCIX, verses 1–8	cat.39	
CIV, verses 1–9	cat.39	
CV	cat.39 and 75	
CVI	cat.39	
CVIII	cat.76	cat.31
CIX	cat.27, 32, 38 and 70 TLS13 and TLS28b (ex-cat.)	cat.31, 33 and 85 TLS39 and TLS40 (ex-cat.)
CX	cat.54	cat.30, 31 and 49
CXII	cat.27, 32, 66, 71, 73, 74, 76 and 80	cat.31, 35, 36, 49, 85 and 106
CXIII	cat.27, 32, 39 and 66	cat.31, 33, 55 and 85 TLS37, TLS41, TLS42, TLS43 and TLS44 (ex-cat.)
CXIV	cat.27, 32 and 88	cat.31, 33 and 35 TLS37 and TLS38 (ex-cat.)

these include locks with talismanic designs,[14] beehive covers, spoons, ladles, scissors and other implements (see, for example, cat.69).

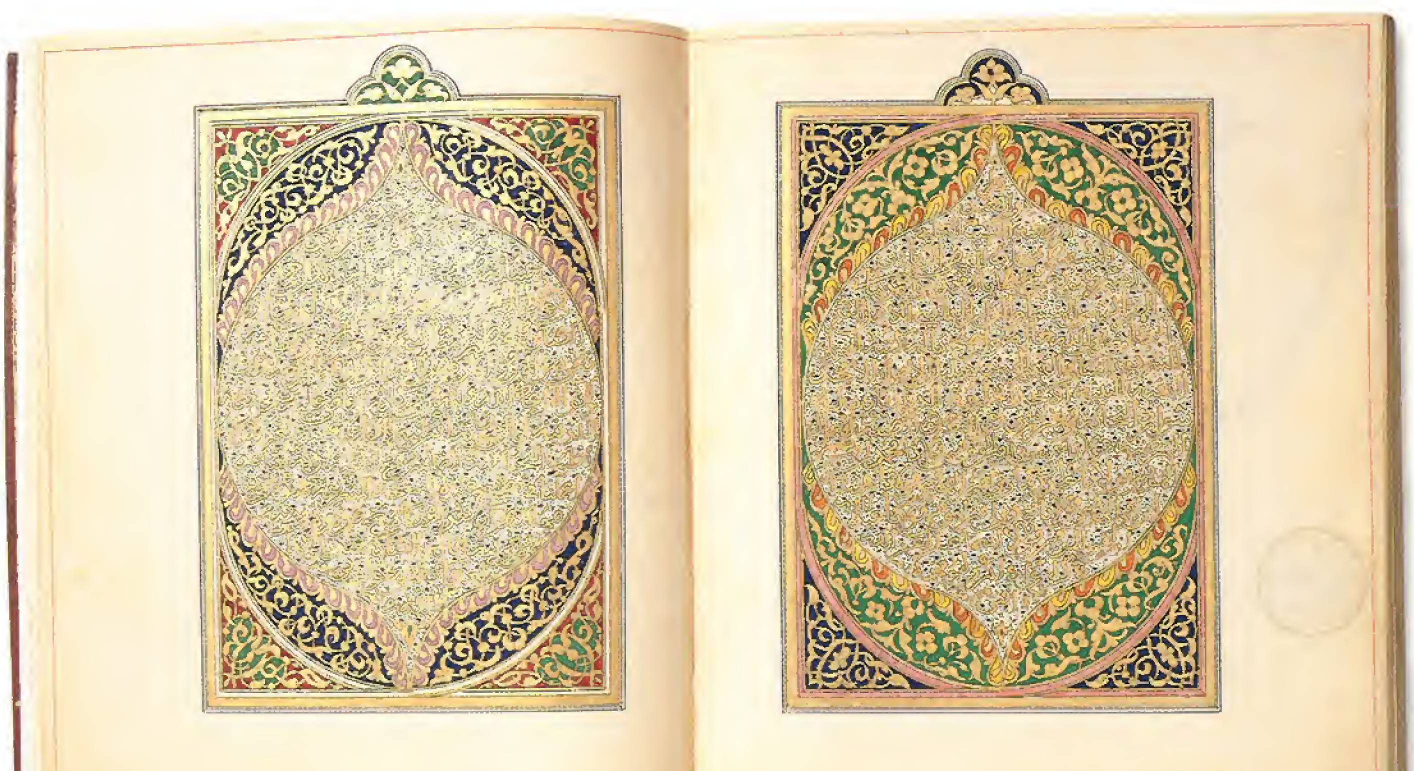
It is almost impossible to align a talismanic design on an artefact with its precise equivalent in the popular magical manuals such as those by al-Buni. Some of the earliest amulets, of the 9th and 10th centuries, have designs that appear to have fallen out of fashion by the 12th century or were used only in provinces distant from Syria and Egypt, where most of the manuals originated. The talismanic rings and gems that have been published bear no resemblance to the elaborate designs suggested in the manuals or in treatises on the use of stones in magic.[15] Of all magical artefacts, magic-medicinal bowls are the most informative, because the early examples are inscribed with their therapeutic uses. The majority of talismanic artefacts, however, fail to specify their intended functions, nor do they name a person or refer to a particular astrological or calendrical moment – such as the Ascendant being in a certain zodiacal sign – in the manner given in the instructions in the manuals. One explanation, perhaps, for this discrepancy between artefact and written source is that most of the objects that have survived were made of a durable material and were probably

intended to provide comprehensive protection for many different occasions. A general function would require a non-specific design, whereas most of those presented in the manuals are for use in very precisely defined circumstances.

There is ample evidence that people of all classes and religions throughout the Middle East, Christians, Jews and Muslims, had frequent recourse to the preventive and curative power of amulets and talismanic objects. In an uncertain world, the educated and wealthy as well as the illiterate and poor employed every means at their disposal to ensure good health and protection from evil and calamity. From the evidence so far available, it would appear that while the magical literature of Islamic societies flourished and nurtured complex theoretical systems, the makers of amulets and other magic equipment maintained a simpler tradition. They employed a more limited number of designs and, with the exception of the early magic-medicinal bowls, manufactured a generic product useful against all calamities. Moreover, Islamic magical practice, in contrast to the theoretical and literary tradition, appears to have maintained a stricter adherence to the Muslim belief that it was only to God to whom one could turn for protection and cure in time of pestilence, disease or any other dreaded misfortune.

1. Numerous attempts have been made to define magic, mostly in terms of European practice, which nearly always invokes forces other than God; see Kotansky 1991, p.123, n.1; and Mauss 1972. The best introductions to Islamic magic are Doutté 1908; Ibn Khaldun–Rosenthal, III, pp.156–227; Dols 1977, pp.121–42; Dols 1992, pp.261–310; Irwin 1994, pp.178–213; Pielow 1995; and see Macdonald 1934. For an extensive bibliography, see Anawati 1972. For pre-Islamic magical antecedents, see Morony 1984, pp.384–430; Faraone & Obbink 1991; Gager 1992; Stol 1993; and Reiner 1995.
2. Protection from *jinn* is mentioned on two talismanic mirrors in the Khalili Collection, cat.55 and 56. The same objects also offer protection from *mārid* and *māridah*, male and female evil spirits disobedient to God, and one (cat.56), safety from every 'accursed demon' (*shayṭān*), which is also invoked on two magic-medicinal bowls (cat.28 and 32) and a talismanic chart (cat.47). For the *jinn*, see Irwin 1994, pp.203–6; and Macdonald *et al.* 1965. For the evil eye, see Seligmann 1910; and Spooner 1970.
3. For the genre as a whole, see Dols 1992, pp.243–60.
4. For healing shrines in Islam, see Dols 1992, pp.211–43; and Crapanzano 1973. For angels, see Macdonald 1990; and Gaudefroy-Demombynes 1911.
5. See Doutté 1908, pp.317–27; Canaan 1937–8, p.147; Donaldson 1938, p.208; and Shinar 1991, pp.133–4.
6. For recent studies of ancient Greek astrological iconography, see Gundel 1992 and Richer 1994; for its influence in Islam, see Hartner 1938; Baer 1968; Hartner 1973; and Savage-Smith 1992a, pp.63–5.
7. For lunette sigla, see Doutté 1908, pp.158–9, 244–8 and 288; and Canaan 1937–8, pp.141–3.
8. This question was raised by Venetia Porter when undertaking the cataloguing of Islamic amulets in the British Museum, London.
9. For a discussion of the various types of magic and Latin squares, see the essay on talismanic charts, p.106–7, below.
10. See Doutté 1908, pp.154–7; Winkler 1930, pp.55–149; Canaan 1937–8, p.144–5; Kriss & Kriss-Heinrich 1962, pp.74–82; and Milstein [1995].
11. A good spirit, *sham 'alawī*, is invoked on one magic-medicinal bowl in the Collection, cat.27.
12. For magic-medicinal bowls stated to offer release from binding spells (*ḥall al-ma'qūd*) and to drive out malicious spirits, see cat.25 and the essay on magic-medicinal bowls, p.76, notes 47 and 48; and note 46 for bowls used to annul sorcery (*ibṭāl al-siḥr*) and combat the evil eye. For exorcisms in the Islamic world, see Crapanzano 1973; Boddy 1989; and Dols 1992, pp.289–306 *et passim*.
13. Harvey 1946, p.766.
14. For a study of locks with talismanic designs, see Torre 1989.
15. For some of the designs for gems recommended in these treatises, see Tifashi 1977; and Lippincott & Pingree 1987. For examples of talismanic gems and rings preserved in the Khalili Collection, see two other volumes of this catalogue, Wenzel 1993 and Kalus, forthcoming.

20, folios 53b–54a



20, folios 220b–221a

20

The *Shams al-ma'ārif* of al-Buni

Marrakesh, dated 4 Rabi' I 1285 (25 July 1868)

20, envelope flap, doublure (top); outer face (bottom)

223 folios, 24.8 × 19.9 cm, of an ivory wove paper, watermarked J. WHATMAN 1847, with the edges ruled in red; the text area, 16.7 × 12.4 cm, with 20 to 21 lines to the page, written in *maghribī* script, is ruled in black, with significant words in gold, red, green or blue; the text is illustrated with numerous tables and diagrams in the same colours; the heading and accompanying marginal device on folio 1b and the lengthy colophon on folios 220a–221b are illuminated in gold, white, blue, green and red; folios 1a, 222, 223 are blank
scribe Muhammad ibn Ahmad Banani
binding burgundy leather covers with recessed centre- and corner-pieces, the design picked out in gold and blue, and some tooling in gold; green leather doublures tooled in gold with an overall repeat pattern
accession no. MSS 556

The most widely read medieval Islamic treatise on talismans, magic squares, and all manner of occult practices was the *Shams al-ma'ārif* ('The illumination of knowledge') written by Abu'l-'Abbas Ahmad ibn 'Ali ibn Yusuf al-Buni al-Qurashi, who died in 1225.[1] Virtually nothing is known of his life, though he is said to have died in Cairo. Of his numerous writings on the occult, the *Shams al-ma'ārif* was the most influential, and al-Buni prepared three versions of varying length: a short one, which was possibly the original form, one of medium-length, and a long one. The latter was apparently the most popular, and its size is reflected in the full title given in this copy, *Kitāb Shams al-ma'ārif al-kubrā* ('The greater [version of the] illumination of knowledge').[2] The treatise comprises 40 chapters dealing with the magical use of numbers and magic squares, the occult properties of certain Qur'anic verses and the *asmā' al-ḥusna*.[3] In it, al-Buni drew on Hellenistic, Jewish and other pre-Islamic magical practices that had passed into the popular culture of his day, as well as incorporating the pious Muslim use of prayers and readings from the Qur'an.

The present copy is a good example of the illumination, calligraphy and bookbinding produced in the scribal workshops of Marrakesh during the second half of the 19th century. According to the illuminated colophon at the bottom of folio 220a, the copy was finished on 4 Rabi' I 1285 (25 July 1868), and in the large illuminated medallion on the following page (folio 220b) the scribe gives his name as Muhammad ibn Ahmad Banani al-Marrakushi.[4] He goes on to specify that Marrakesh was his home since childhood (*al-mansha'*), that his family was from Fez (*al-dār al-Fāsī al-aṣl*) and that he was descended from the tribe of Nafzi (*al-Nafzī al-nujār*).[5]

The scribe states in the same medallion that the copy was prepared for Mawlana Hasan ibn Amir al-Mu'minin Mawlana Muhammad ibn Amir al-Mu'minin Mawlana 'Abd al-Rahman ibn Amir al-Mu'minin Mawlana Hisham ibn Amir al-Mu'minin Mawlana Muhammad ibn Amir al-Mu'minin Mawlana 'Abdallah ibn Amir al-Mu'minin Mawlana Isma'il. From this it is evident that the copy was produced for the future Sultan Hasan I of Morocco (*reg.* 1873–1895), during the reign of his father, Muhammad IV (1859–1873). In two subsequent full-page illuminated medallions the scribe, after seeking the blessings of God upon the recipient, provides unusually detailed information about his method of collating the manuscript and obtaining the best possible text.

The present copy is the final volume from a two- or three-volume set, and contains only the last two chapters of the treatise, the illuminated heading on folio 1b stating that the text begins with the third part (*juz'*) of the treatise. Beneath the heading, the text begins with the 39th chapter (*faṣl*), the longest in the treatise, on the occult use of the *asmā' al-ḥusnā*. The copy then concludes with the 40th *faṣl*, related to prayers and invocations, followed by an appendix (*khātimah*) giving various chains of authorities for scholars in relevant areas of expertise such as the magical uses of letter-numerals (*'ilm al-ḥurūf*). In the modern printed editions of this treatise, the entire composition is divided into four rather than three parts, and in these editions the 39th and 40th chapters, as well as the appendix, are consequently placed at the end of the fourth, rather than the third, *juz'* as here.[6]

This copy includes a number of carefully drawn diagrams and magic squares, some with gold decoration. A particularly well-executed example, which is more informative than the equivalent in the printed versions, occurs on folio 54a in the discussion of one of the *asmā' al-ḥusnā*, namely *'alīm* ('Omniscient'). The chart is intended to illustrate the relationship of God with the *jinn*. God is represented by some of His names written within circles placed in a stylized human form, while the *jinn* are represented by symbols at the bottom and right-hand side of the diagram.[7]

There are marginal corrections by the scribe and some extensive glosses.

1. Ullmann 1972, pp.234, 390–91; Dietrich 1981.
2. The title is given on folio 1b in the illuminated heading and on folio 220a, in line 2 of the illuminated colophon.
3. For the divine names or epithets of God, *al-asmā' al-ḥusnā*, see Gardet 1960; Doutté 1908, pp.199–203; Fahd 1966, pp.234–41; and Gimaret 1988.
4. The intended vocalization and meaning of the word 'Banani' are unclear.
5. For the name of this Berber tribe, see 'Nafza' 1993.
6. The text corresponds to that in al-Buni, Part 4, pp.22–140; and al-Buni – al-Adhami, Part 4, pp.19–123.
7. See Irwin 1994, pp.203–206, and Dols 1992, pp.212–15.

21

A treatise on the magic properties of letters and magic squares

Middle East, 16th century

198 folios, 21 × 15.3 cm, of a dark-cream, burnished European laid paper with 13 laid lines to the centimetre and single chain lines; the text is written in three different *naskh* hands in two different types of black ink, with rubrications: on folios 3b–12b, 25 lines of a well-formed, slightly angular *naskh* written within a text area 15.6 × 9.5 cm; on folios 13a–22b, 25 lines of a more cursive but still clear hand within a text area of the same dimensions; and on folios 23a–198a, 19 lines of a slightly larger, similarly cursive hand within a text area 16.5 × 8.5 cm; all three sections are illustrated with numerous tables and diagrams in black and red; folios 1–3a, 198b bear later notes
binding burgundy leather covers and flap, ruled in blind with a double frame and set with a centre-piece and pendants, corner-pieces and border cartouches stamped in gold on separate pieces of leather; doublures of dark-cream laid paper printed with a floral design in gold
accession no. MSS 243

This is the only recorded copy of a previously unknown treatise on magic squares and the magical properties of letters, titled *Talkhīṣ ishrāq Shams al-āfāq* ('The epitome of the illumination of the *Shams al-āfāq*'). The anonymous author of this abridgement gives the title of the treatise in the preface (folio 4a, line 6) and again at the beginning of the conclusion (folio 168a, line 14). He states (folio 4a, line 5) that he based it on *Shams al-āfāq fī ma'rifat al-ḥurūf wa'l-awfāq* ('The sun of distant lands regarding knowledge of the magical properties of letters and magic squares'), a treatise that was written in 1423 by 'Abd al-Rahman al-Bistami, a Syrian mystic of the Hurufi order of dervishes who moved to the Ottoman capital and gained the favour of Sultan Murad II, to whom the treatise is dedicated.[1]

The treatise consists of an introduction (*muqaddimah*) in 28 sections (*faṣls*) on the magic attributes and alignments of letters; 28 *durrahs* ('pearls'), one devoted to each letter of the alphabet, with an addendum (*khātimah*) on *lām–alif*, each with associated magic squares, Latin squares and talismans; and a conclusion (*khātimah*) in two chapters (*faṣls*).[3] In the conclusion, an interesting history of the art of letter magic gives the names of various sources and authorities including Pythagoras, Plato, Hermes and Galen (folios 168b–173b). This is followed by 28 *lu'lu'ah* (again, 'pearls'), in which each letter of the alphabet is assigned talismanic uses (folios 173b–186a). Various Arabic authorities are cited.[4] On folio 198b a later hand has written a prognostication chart from which, using the numerical value of a name, it can be determined whether an absent person is living or dead. Folio 3a carries a lengthy later note on the talismanic uses of the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255).

An owner's note, also on folio 3a, is dated AH 1164 (AD 1653–4) and written by Amir ibn 'Abd al-Rahim ibn Amir Husayn ibn Amir Muhyi al-Din Ja'far, whose seal, which is of Ottoman design, appears twice on the folio. In the note he states twice that the volume contains the well-known treatise *Shams al-ma'ārif* by Ahmad ibn 'Ali al-Buni. The attribution to al-Buni is repeated in a transfer of ownership on the same folio. However, the present treatise is not the same as al-Buni's work, and indeed the fact that it is based on the writings of al-Bistami rules out that possibility.

The manuscript is undated, but the script, paper and inks would suggest a date in the 16th century. Folio 68 is bound upside down, and a break in the text occurs between folios 65 and 66. There are scribal corrections and marginalia in several hands.

1. Al-Bistami died in AH 858 (AD 1454). See Brockelmann 1897–1902, II, p.232; Smith 1960; and Fahd 1966, pp.228–30.
2. The introduction occurs on folios 3b–35b; the *durrahs* and addenda on folios 35b–168a; and the conclusion on folios 168a–198a.
3. For example, folio 187a mentions Abu al-Qasim al-Qashiri, Abu al-Hakim ibn Burhan, Abu al-'Abbas al-Iqlisi, Abu Hamid al-Ghazali (d. AH 505/AD 1111), Abu al-'Abbas al-Sabti (who died, according to some, in AH 698/AD 1298 or who, according to others, was still alive after AH 796 (AD 1393), and Abu al-Hasan al-Shadhili (d. AH 656/AD 1258). Nothing is known of the first two figures. Al-Iqlisi may be the same as Abu'l-Qasim al-Iqlishi al-Andalusi, dates unknown, who wrote a treatise on the magic properties of the letters of the alphabet (Ahlwardt 1887–99, entry no.4132). Al-Ghazali was a famous theologian to whom many occult writings were falsely attributed. For al-Sabti and al-Shadhili, see Brockelmann, supplement, I, pp.909–10 and 804–6, respectively.

22

A treatise by al-Buni on the magical uses of the names of God

Middle East, dated 16 Dhu'l-Qa'dah 828 (24 September 1425)

121 folios, 26.0 × 17.6 cm, of a thick, creamy, fibrous, burnished laid paper with 8–9 laid lines to the centimetre and chain lines in groups of three; the text area, 19.5 × 13.0 cm, with 21 lines of *naskh*, in black, with rubrications, the vowelling on folios 1–9 added later; the text is illustrated with numerous diagrams in red and black, with labels written in two sizes of a more careful hand; folios 1a, 119b–121b filled with notes and texts in various hands
scribe 'Abd al-Muhsin ibn Ahmad ibn Ahmad al-Kutubi al-Baghdadi
binding later covers of burgundy leather, with a border tooled and ruled in gold and a stamped centre-piece outline in yellow, lined with plain paper
accession no. MSS 300
published Maddison & Savage-Smith 1993, pp.44–5

This manuscript contains the earliest recorded copy of a treatise on the magical uses of the names of God written by the foremost authority on the occult, Abu'l-'Abbas Ahmad ibn 'Ali ibn Yusuf al-Buni al-Qurashi, who was also the author of the *Shams al-ma'ārif*, discussed above, cat.20. He is named as the author on folio 2b, lines 3–4, while the title page (folio 1a), written in a later hand and on different paper from the rest of the volume, states that the treatise is entitled *Kitāb al-ta'līq* ('Book of the oblique') and is by Imam Abu al-'Abbas Shihab al-Din Ahmad al-Buni. Although this title is not found within the present volume, the text itself appears to correspond to that of a manuscript in Vienna, copied in the city of Valljevo, south-west of Belgrade, on 29 Jumada II 963 (10 May 1556), which gives the title as *al-Ta'līqah* ('Explanatory comment') and also as *Luma'āt nūrāniyyah* ('Brilliant lights').[1] The Vienna manuscript is the only other recorded copy of al-Buni's composition.

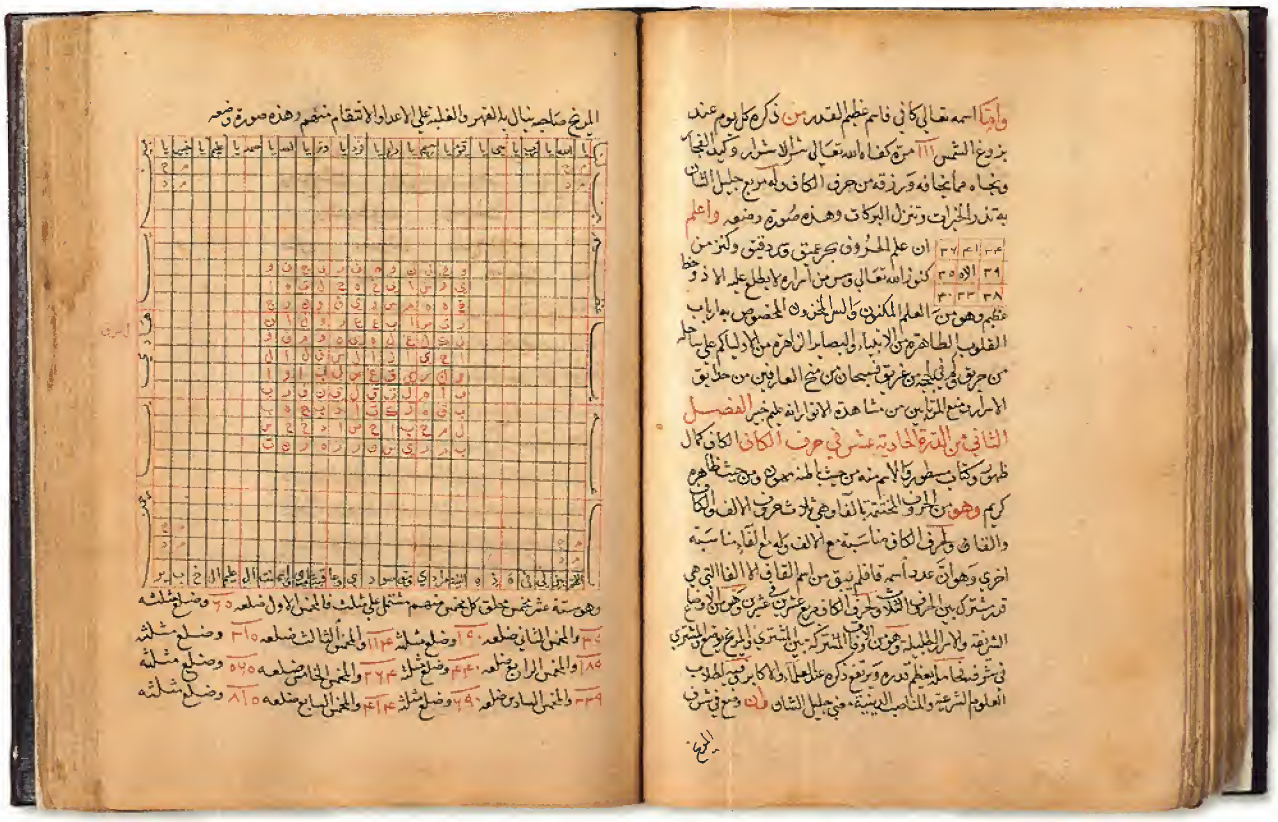
The treatise consists of six sections (*faṣls*), of which the first five constitute a general introduction to the occult uses of the 99 names of God, *al-asmā' al-ḥusnā*. The sixth *faṣl* concerns specific talismans employing the divine names (folios 11a–40b), individual verses of the Qur'an and their talismanic use (folios 41a–118a), and a general discussion of magical alphabets (folios 118a–119a). The treatise presents numerous magic squares and talismanic designs, useful in circumstances such as petitioning patrons, sowing crops and releasing bees from their hives, or for such purposes as assuring safety on board ship and success in battle, averting plague, providing protection from a scorpion, controlling fever, quelling the crying of children, stopping epileptic seizures and alleviating headaches and aching joints. Al-Buni cites several authorities on these matters, about whom nothing further is known.[2]

Folios 119b–120b contain extracts in Persian from two chapters (*bābs*) on making brass look like gold, a Qur'anic quotation (X, verse 24), various pious phrases, a magic square, magic numbers and letters, and a magic alphabet, all added later in a casual hand. Folios 121a–121b contain various magic and pious statements in Arabic and Persian, with a later addition of magic phrases and a 3 × 3 magic square.[3] Folio 2a has a later note in a very casual hand giving magic formulas, while folio 1a has a note giving the date of the manuscript, a recipe, and a title, *Kitāb-i khawāṣṣ* ('Book of occult properties').

The whole text has catchwords and some marginal corrections by the scribe; headings and other marginalia are in various hands.

1. Vienna, MS.a.f.162a(76); see Flügel 1865, II, pp.562–3, no.1492; the word *al-ta'līqah* occurs in the present manuscript in reference to the first *faṣl* (folio 3b, line 2). There are other treatises by al-Buni with the title *al-Luma'āt al-nūrāniyyah*, such as Bodleian Library, Oxford, MS. Bodl.Or.443, but these are quite different in content.
2. Sahl ibn 'Abd Allah al-Tustari (folio 3b), Abu Ishaq al-Khurasani (folio 5b), Sharaf al-Din ibn 'Asam (folio 8a), and Abu Zakariya', who wrote *al-Tadhkirah* (folio 110a).
3. For the various types of magic squares, see pp.106–7.

21, folios 18b–19a



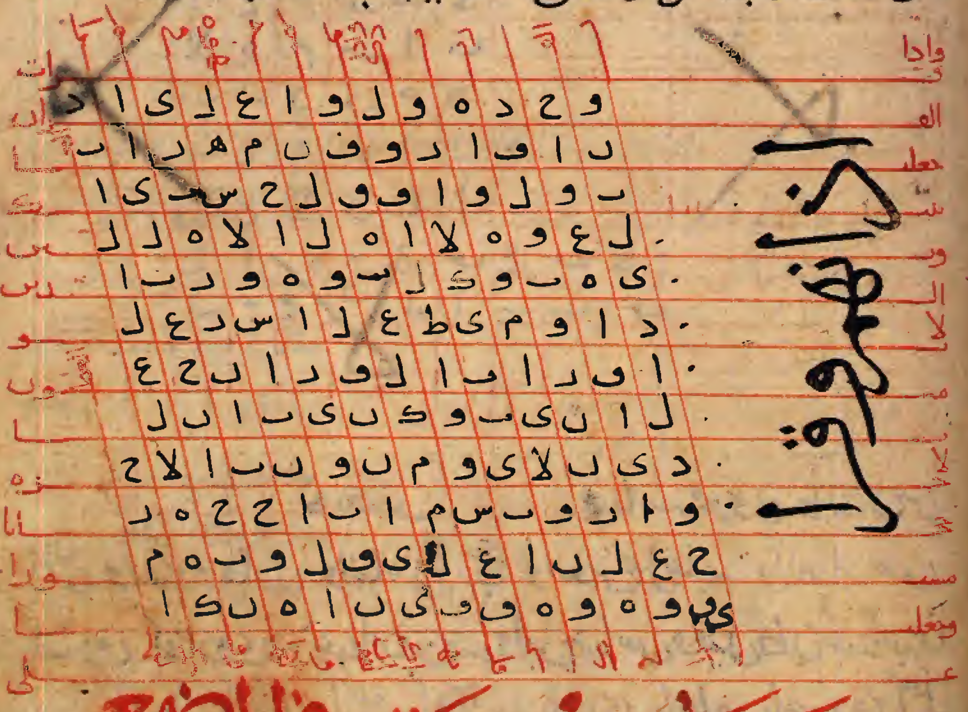
21, folios 94b–95a

قوله تعالى واذا قرات القران جعلنا بينك وبين الذين لا يومنون بالاخرة
حجابا مستورا وجعلنا على قلوبهم اكنة ان يفقهوه وفي اذانهم وقرا
واذا ذكرت ربك في القران وحده ولوا على ادبارهم نفورا وقوله تعالى
فان تولوا فقل حسبي الله لا اله الا هو عليه توكلت وهو رب العرش العظيم
هاتان الايتان الكريمتان لطرد المردة من الجن والانس والشياطين
ووسواسهم وتخويفهم وارهابهم اذا كتبتا للخايف المذعور الذي يتخيل
الخيالات الفاسدة زال ذلك عنه بعون الله تعالى واذا علقت على من به تابع
من الجن زال عنه تابعه ونفعه وكذلك ان قريت عليه زال ما يجده من الخوف
وان رسمت كما تجدها في قرطاس وعلقت عليه ذهب عنه ما يجده بعون الله تعالى

لطرد الجبابر

لطرد الخيالات

مطلب

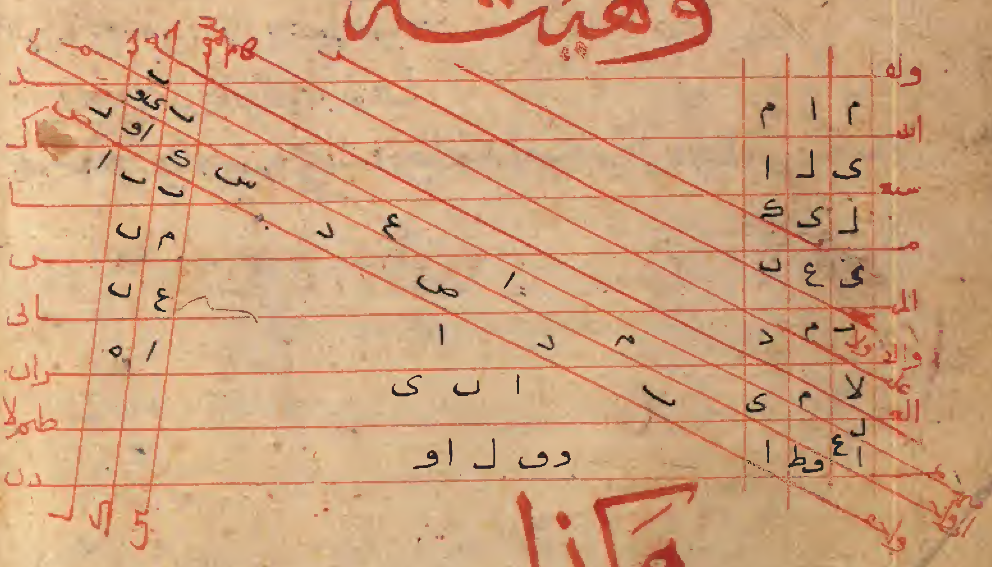


وهذه صورته في الوضع

22, folios 62b–63a

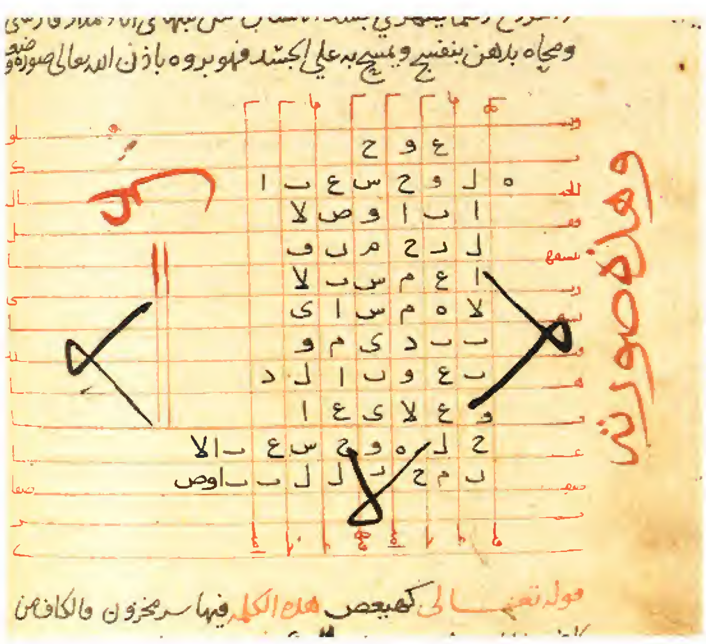
منافعه ومن ارادها لنمو الثمار وصلاح الغراس والزرع فليصنع اللوح في
المكان او علي بابه يكون ذلك بعون الله تعالي وهذا صوره وضعه هذا
قوله تعالى ولقد اتيناك سبعًا من المثاني والقران العظيم لا تمدن
عيناك الى ما متعنا به ازواجًا منهم ولا تحزن عليهم واخفض جناحك
للمومنين هذه الايه لغض الطرف وخفض الجناح والتواضع للناس فمن
كان يمد طرفه الي حُرم الناس واراد الخروج عن ذلك فليستغفر الله مايه مره
او الف مره فهو احسن ويكون ذلك ليله الجمعه ويقوم في السحر ويتوضا
ويصلي ركعتين ويتعوذ بالله من شر ما يغضبه ويرسم الايه في انيه طاهره
ويمحاها بالماء الطاهر ويقرا عليه الايه ويرش ذلك الماء علي بدنه ويشرب
منه سبعه ايام متواليه يزول عنه ذلك وتفتح له ابواب الجنه والبركه والتوبه
وان عملها لغيره مع ذكره للاستغفار والاستعاذه ويسقيه الما ويرش
بدنه يكون ذلك بعون الله تعالى ولطفه وهذه صوره وضعه

وهيئته

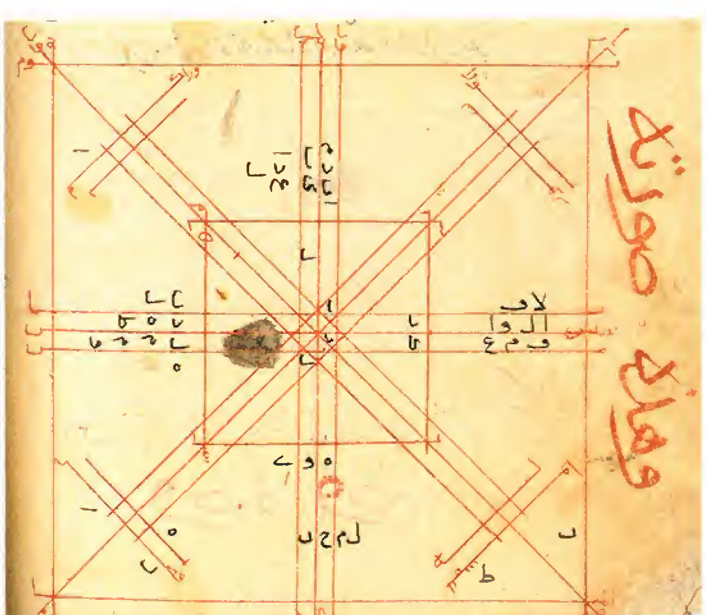


هكذا

22, detail of folio 48b



22, detail of folio 63b



22, detail of folio 101b

23

Bi-folio from an astrological manuscript

Morocco, 19th century

2 folios, 21.8 × 16.6 cm, of an ivory wove paper; the text area, 15.7 × 10.6 cm, is ruled in blue, black and gold and contains 20 lines of a *maghribī* bookhand written in black, with significant words in gold, red, green or blue; the text is illustrated with two diagrams in gold, black, blue and two shades of red
accession no. MSS714

This bi-folio is a fragment from a 19th-century North African copy of an unidentified treatise on astrology. From the sources cited it is evident that the treatise was composed sometime after the 13th century. The extant text contains the beginning of a section called *al-mabḥath al-khāmis* ('The fifth topic'), and is concerned with the alignment of letters of the alphabet with the lunar mansions, the zodiacal signs, the *asmā' al-ḥusnā*, and the names of angels (here called *al-rūḥānīyah*).

After citing several authorities, including the late 13th-century author Ibn Sab'in, an authority on the beneficial uses of passages from the Qur'an,[1] the author goes on to say that there are three differing opinions regarding the alignments of letters of the alphabet with the lunar mansions and the signs of the zodiac. The lunar mansions are 28 groups of stars, or asterisms, that reflect a pre-Islamic system of season- and weather-prediction by using certain prominent star groups. They played a large role in astrology, and the fact that there were 28 of them invited a magical association with the 28 letters of the alphabet and then with all other items, such as the elements and seasons, with which the letter-numerals were associated.

The first interpretation the author attributes to the famous 13th-century authority on the occult, al-Buni, and to Ibn 'Arabi, that is Muhyi al-Din ibn al-'Arabi, who died in 1240.[2] In the diagram illustrating this first view, on folio 2a, the names of the two authorities are written at the centre of the concentric circles. The surrounding ring is blank, while the next ring has seven letters in the *abjad* order of letter-numerals written in each quadrant.[3] The succeeding ring has the names of three zodiacal signs assigned to each quadrant. The four outermost concentric rings are divided into 28 compartments, the innermost containing the 28 letters of the alphabet in the same order as given earlier, although one has been inadvertently omitted in the first quadrant. There then follows a ring with the names of the 28 lunar mansions, surrounded by a ring of 28 of the *asmā' al-ḥusnā*. The outermost ring contains the names of 28 angels.

The second theory is illustrated by another circular diagram on folio 2b that has the name Samur al-Hindi written at the centre. An Indian authority on the occult named Samur is occasionally cited in other astrological and magical treatises, but nothing is known of his life and his ideas are known only indirectly through citations.[4] The innermost ring in this diagram has the name of one of the four elements – fire, earth, air, water – written in each quadrant. In the surrounding ring each quadrant contains seven letters of the alphabet, but in this case they are not in their *abjad* order but rather are grouped as the letters are associated with the four elements. The next concentric ring has three zodiacal signs written in each quadrant, again as they are associated with the elements. The outermost four rings are divided into 28 compartments, the innermost repeating the letters of the alphabet. The next ring has the 28 lunar mansions, not in sequence but as associated with the elements, and the two outermost rings contain 28 of the *asmā' al-ḥusnā* and 28 names of angels.

The two circular diagrams share many of the features found in a diagram on folio 8b of cat.21.[5] Unfortunately, the fragment breaks off after the second diagram and we do not learn what the third theory regarding the alignments of letters and sacred names with zodiacal signs and lunar mansions was.

1. Ibn Sab'in, an authority on *khawāṣṣ al-Qur'ān*, was born in AH 668–9 (AD 1270); see Fahd 1966, p.242.
2. Amongst the numerous writings of Ibn al-'Arabi were several treatises containing astrological and divinatory material, such as his *Kitāb Qabs al-anwār wa-bahjat al-asrār*; see Ullmann 1972, pp.340–41; and Ateş 1971.
3. For *abjad* letter-numerals, see Table 2, p.199, below.
4. See Ullmann 1972, pp.382–3.
5. In the latter diagram many of the labels have been over-painted and new inscriptions added.

23, folio 2a

23, folio 2b

Magic-medicinal bowls

by Emilie Savage-Smith

Magic-medicinal bowls are distinct among magical artefacts for a number of reasons: they were not carried with the sufferer, and they did not function continuously, as a household or personal amulet would have done; they were employed only when needed; they were of a durable material; and, when the afflicted person was unable to sip from the bowl, a proxy could be appointed to drink on his or her behalf. The 20 Islamic magic-medicinal vessels in the Khalili Collection, whose dates of manufacture span more than a millennium, from the late 8th century to the late 18th or early 19th century, represent nearly all the previously recorded types of Islamic magic bowls and include some designs which are otherwise unknown in scholarly literature.

Even though large numbers of Islamic magic bowls were made from at least the 12th century, and probably earlier, there are almost no references to them in contemporary medical or magical literature. Only two references have so far been found in written sources. At the end of a 13th-century copy of an Arabic Alexandrian treatise on urine, a magical formula against colic or intestinal obstruction is given with instructions to inscribe it on a red copper plate or bowl when Scorpio is in the ascendant, or to carve it – at any time – on a bowl of walnut wood. If the sick person drinks from the vessel, the treatise continues, the affliction is eliminated and the poison carried off immediately or – if his agent drinks from it – after an interval of time.[1] In the late 14th century the cleric al-Sanawbari (d. 1412) included in his own treatise on Prophetic medicine a recommendation that protection against delusions and melancholia (*waswās*) could be gained by drinking, before breakfast for three days, a liquid from a bowl on which Qur'anic verses and a particular magic square had been written.[2]

From the evidence of the objects themselves, the manufacture of Islamic magic-medicinal bowls in metal seems to have been well-established in Syria and Egypt by the 12th century. In concept and design they probably evolved from several earlier traditions, one of which is represented by the early Islamic dish in the Khalili Collection, cat. 24, which must have been made around the 9th century; the figural representations and some of the magical designs on this item can be traced to pre-Islamic concepts. There must also have been a strong influence from the earthenware pre-Islamic magic bowls with Jewish Aramaic, Syriac and Mandaic inscriptions, although the connection between the latter and the Islamic magic bowls was not a linear one. The pre-Islamic vessels were made of clay and bore inscriptions invoking demons written in ink in a spiral;[3] the extant Islamic bowls are of metal and their inscriptions, often written in concentric bands, noticeably lack any references to *jinn* and demons, being instead conspicuous for their invocations addressed directly to God. Four undated though evidently later bowls with Judaeo-Arabic inscriptions – that is, Arabic invocations written in Hebrew script – were engraved, possibly prior to the 12th century, for the same individual, Muhibb ibn ʿAtiqah, and represent yet another variant within the tradition of magic-medicinal bowl production.[4]

In the Islamic world, the magical tradition of maintaining well-being, curing illness and relieving the pain of childbirth through drinking water that had touched Qur'anic texts was well established. For example, the 9th-century treatise from the Twelver Shiʿi tradition of Prophetic medicine, the *Ṭibb al-a'immah*, refers several times to Qur'anic verses being written in ink on paper and then washed in the water that was to be subsequently consumed. It also mentions the practice of reciting a certain Qur'anic verse 30 times over a bowl of water that is then to be drunk.[5] Similar recommendations are made by the Sunni theologian and historian al-Dhahabi (d. 1348) in his own treatise on Prophetic medicine.[6] The next logical step was to engrave the verses upon a metal bowl which could then be used repeatedly.

Early types

The earliest such Islamic bowls preserved, other than cat. 24, are hemispherical in shape, engraved with their therapeutic uses, and often depict animal or human figures in schematic form. Fifty-nine of this type are known either through publication or examination.[7] The entire group are Syro–Egyptian products. The vessel bearing the earliest reliable date was made in AH 563 (AD 1167–8), two years before cat. 25 and for the same patron, Nur al-Din ibn Zangi, who ruled Syria from 1146 until 1174, when the Turkish Zangid rule ended with the ascendancy of the Ayyubids under Saladin.[8] It is worth noting that Ibn Zangi was the founder of the important hospital in Damascus that bore his name, the Nuri hospital. His interest in magic-medicinal bowls as well as in hospitals indicates that he was open to a variety of approaches to medical care.

The magic-medicinal bowls bearing dates earlier than that on the Ibn Zangi bowl are all problematic, for the dates inscribed do not correspond with those of the given patrons. One bowl, for example, is recorded as having been made in AH 570 (AD 1174–5) for Asad al-Din Shirkuh, the uncle of Saladin who entered the service of Ibn Zangi, even though Shirkuh died in AH 564.[9] Its inscription also confers on its 'patron' the title of Sultan, a title Shirkuh was not authorized to bear because he was not an independent prince.[10] Fifteen magic bowls are stated to have been made for Abu al-Muzaffar Yusuf, that is, for Saladin, the founder of the Ayyubid dynasty in Egypt who ruled from 1169 to 1193. Of these, four are dated AH 580 (AD 1184), six are said to have been made in Mecca and all apparently bear a schematic engraving of the Ka'bah at the centre of the interior.[11] Since these bowls also have personal names and titles not otherwise associated with Saladin it is likely that the attribution to a ruler was added by the maker to give the item added authority. A number of the early bowls of this design also state in their inscriptions that they were copied from others that were in a royal treasury, implying that such an association would increase their validity and potency.[12] Judging from the appearance of many of the extant examples, copies of bowls with the centralized depiction of the Ka'bah continued to be made over a long period of time.

The spurious ascription of a magical bowl to a prominent ruler in order to enhance its value is exemplified by cat. 26, which was probably made in the 13th century but is stated to have been made in AH 502 (AD 1108) for the Abbasid Caliph in Baghdad, al-Musta'sim bi'llah, who died in AH 656 (AD 1258).[13] Magic bowls were also ascribed to other 13th-century rulers, including the Mamluk ruler al-Zahir Rukn al-Din Baybars (*reg.* 1260–1277), and the Rasulid ruler of Yemen al-Malik al-Muzaffar Shams al-Din Yusuf (d. 1295). For various reasons, these ascriptions are also suspect.[14] It is only with the Mamluk ruler al-Mu'izz 'Izz al-Din Aybak (d. 1257) that we find an example with a dedication that seems legitimate.[15] There is considerable similarity in overall design between this bowl and one in the Khalili Collection, cat. 28, which is undated and lacks a patron's name.

'Poison cups'

Another group of early Islamic magic-medicinal bowls that has attracted considerable scholarly attention are the 'poison cups'.[16] Like the bowls discussed above, these 'cups' are always hemispherical in shape and their inscriptions include a list of therapeutic uses. In other respects, however, their designs differ. Poison cups are consistent in their representations of a scorpion, a serpent, an animal that is probably intended to be a dog – though some have called it a lion – and two intertwined dragons. They also bear fairly consistent magical formulas or words, at least one magic square, and other magical symbols, such as five-pointed stars. Unlike the previous group, the poison cups are never dated, although the

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Magic-medicinal dish

Provenance unknown,
late 8th – early 9th century

Lead, cracked in places
height 0.9 cm (approximate)
rim 7.1 × 6.5 cm
accession no. MTW621

This small, very early dish is inscribed with both Qur'anic phrases and several decorative motifs typical of earlier Sasanian wares. Although its inscriptions and decorative elements do not follow the pattern usually associated with magic-medicinal bowls, it can be considered a prototype magic-medicinal bowl for, like later bowls of more familiar form and design, the pious inscriptions, amplified by the beneficial effects of astrological and magical symbols, must have been thought to provide divine protection. Presumably it also functioned in a manner similar to that of the later bowls, in that protection was sought through sipping or sprinkling from the bowl a liquid that had been touched by the words of the Qur'an. In this case, however, the broad rim would have made drinking from the dish difficult, and the pious phrases occur on the underside of the vessel, so that whatever was placed in the dish did not come into direct contact with the words. Perhaps the efficacy of the dish was believed to be similar to that of mirrors, where the pious and talismanic inscriptions were often on the back of the object.[1]

The dish appears to have been struck, like a coin, from a lead ingot. The square rim is very large in proportion to the rest of the shallow vessel. The designs on both the interior and exterior of the piece are in relief. On the flat underside of the circular bowl there is a two-line inscription reading 'In the name of God' and 'God sufficeth me!' The latter is a Qur'anic phrase which occurs in the surahs *al-Tawbah* (IX, verse 129) and *al-Zumar* (XXXIX, verse 38). The calligraphy employed is typical of early Islamic scripts of the 8th to the 9th century.[2] The inscriptions have stars above and below, a feature of Roman magic gems and one which continued in use in the Islamic world until the 13th century.[3] The sloping outside walls of the dish are decorated with vertical ridges

name of one maker, a certain Muhammad ibn Yunus of whom nothing is known, does occur on three bowls.[17]

All 22 of the poison cups recorded to date, and no doubt many more in unpublished collections, appear also to be Syro–Egyptian products. None can be dated with any certainty as they continued to be copied for several centuries, and all of them are virtually identical except for the external therapeutic inscriptions. Occasionally, there might be a statement on the object to the effect that it was copied from an exemplar in a royal treasury.[18] However, as in the case of other magic-medicinal bowls, it would be unwise to use such statements as a means of dating either the vessels or their exemplars.

The term 'poison cup' is somewhat inappropriate for these magic bowls, for providing an antidote to poison was only one of a large number of uses assigned to them in the inscriptions they bear. Furthermore, not all poison cups even mention poison. It must be allowed that protection from the effects of animal bites and stings does form a substantial part of their repertoire of uses, but the same is true of earlier magic bowls of the type represented by cat.25, 26 and 28, which are not designated as 'poison cups'.

Applications for early magic-medicinal bowls

Of all magical artefacts, the early hemispherical magic-medicinal bowls and their copies are the most informative about the medical conditions for which their use was prescribed. To date, 83 magic-medicinal bowls are recorded as having therapeutic inscriptions engraved on them: 59 of these were either examined personally or have been published in sufficient detail that their prescribed uses might be compared in the following survey. The inscriptions on these vessels provide an interesting guide to the diseases and afflictions considered prevalent at the time – or at least at the time the earliest bowls were designed – and, of course, to those thought to be responsive to magical formulas.

From the number of references on these bowls it would appear that in Syria and Egypt in the 12th and 13th centuries there was an overriding concern with scorpion stings and the bites of snakes and mad dogs.[19] Scorpions were, and still are, a dreaded feature of life in arid climates. It is interesting to note, however, that rats and other rodents are not mentioned. On seven bowls there are general terms used for any creeping and crawling creature, especially reptilian.[20]

The ailments and diseases that dominate the inscriptions are various gastro-intestinal complaints, mentioned in total 135 times: colic,[21] general abdominal pain,[22] gastric pain,[23] abdominal pain caused by eating herbs with earth on them,[24] flatulence,[25] dropsy,[26] difficulty in urination,[27] and haemorrhoids,[28] and two statements to the effect that the use of the bowl is a general aid to the stomach.[29] The suggestion that the use of a bowl is beneficial to the spleen and kidneys is cited six times and once respectively.[30]

The next most frequent application of the bowls was to assist a woman in labour and ease a difficult birth. This is mentioned 67 times on the bowls, sometimes repeating the idea in different words.[31] Associated with it is the occasional statement that the bowl should also be used to increase the milk of a nursing mother, as seen on cat.26 and 28.[32] Calming the restlessness of babies is mentioned six times,[33] but infertility only once.[34]

Headaches of one form or another are mentioned 48 times.[35] Throbbing pains in general are named 36 times,[36] but toothache is specified only once, on cat.26.[37] The stopping of nosebleeds is mentioned 13 times,[38] while preventing haemorrhaging in general is listed 39 times.[39]

The usefulness of magic-medicinal bowls as antidotes to poison is mentioned only 35

and the bottom and upper edges are encircled by a pearl border.

In each corner of the underside of the flat rim there is a four-petalled flowerhead with visible calyxes, drawn in a manner reminiscent of the flowers on some Sasanian metalwork of the 5th and 6th centuries,[4] and on Umayyad textiles of the late 7th to mid-8th century.[5] Two animals – one a creature like a cat or a very elongated fox with a long thin tail, the other a quadruped with large ears, arched back, and a broad flat tail like a beaver's – are also depicted twice on the underside of the rim.

On the upper side of the vessel, the upper and lower edges of the depression are decorated with small dots and the interior sloping walls with ridges, the overall effect being reminiscent of a circular cloth or leather pouch sewn together with a type of loop stitch, sometimes called a Cretan or Persian stitch. The illusion of hand-sewing is reinforced by the decoration at the outside edge of the square rim, which is slightly raised and reproduces the form of blanket stitch, another looped stitch used as an edging.

At the bottom of the dish there is the image of a winged horse, with a flowerhead like those on the underside of the rim and another small flower in the background. The wings of the horse are depicted in an abstract manner similar to that found on Sasanian wares.[6] An even more common Sasanian motif is the bird holding a flowering plant or vine: this is clearly reflected in the 16 birds, possibly peacocks, that parade around the upper face of the rim, single males in each corner with three females placed along each side.[7]

With the exception of the animals on the underside of the rim, which are unusual in form, the decorative elements and calligraphy on the dish are consistent with those on other early Islamic pieces that maintain Sasanian traditions of design. However, no magic dish of a similar design has been recorded.

1. See the essay on talismanic mirrors and plaques, pp. 124–5.
2. For example, the form of the final *mīm* – rounded with a short extension to the left – and the *yā'* with a retroflex tail can be seen on a glass weight dated AH 111/AD 729–30 (Grohmann 1971,

24, front

24, back

pl.xvii, 4); on letters and petitions of the 9th century (Khan 1993, p.92, no.42 and p.96, no.44); and on the lease of a shop for the period AH 280–9 (AD 893–902) (Khan 1993, p.181, no.101).
3. See Wenzel 1993, p.38, cat.104.
4. For example, see the floral design under the front paws of a lion on a silver plate of the 5th or 6th century, now in the Hermitage Museum, St Petersburg; Erdmann 1943, pl.72. See also that employed on a gold dish of the 6th century, now in the Bibliothèque Nationale, Paris; Pope 1938–9, vi, pl.203.
5. See, for example, London 1976, p.73, no.1.
6. See the central design on a silver plate now in the Hermitage Museum, St Petersburg; Erdmann 1943, pl.71. For the development of the winged-horse image in Byzantine, Sasanian and later Islamic art, see Ettinghausen 1972, pp.11–16.
7. For other examples of this motif, see a cast-iron ring of the 5th or 6th century now in the Khalili Collection (Wenzel 1993, p.184, cat.5); and the central designs of two silver plates now in the Hermitage Museum, St Petersburg (Pope 1938–9, vi, pls 215B and 216A).

times. The bowls are occasionally said to be effective in increasing physical strength as well as alleviating facial paralysis, both indicated with words that are easily confused with one another.[40] Other named uses are the cure of colds, catarrh and epilepsy.[41]

There is no mention of any specifically contagious condition – that is, one that was said in the medical literature to be transmissible or which we know today to be so – except for ophthalmia, which is specified on five of the earliest bowls, including cat.25 made for Ibn Zangi.[42] Fevers – an accompanying symptom of many contagious conditions – are mentioned in general terms on 31 of the 59 bowls surveyed, with more specific fevers named on 20 bowls.[43] There is also one mention of pustules that arise on the body and another of erysipelas, an inflammation and reddening of the skin especially on the face, together with pustules.[44]

The use of these bowls for the 'annulling of sorcery' (*ibṭāl al-siḥr*) is recommended 26 times, with 23 recommendations for their use against the evil eye, assuming that this mention of the eye was not intended medically.[45] Driving out malicious spirits is mentioned on five bowls, including cat.25,[46] and one of these is also prescribed for use against magic spells (*ruqan*). On four vessels, which again include cat.25, their usefulness in releasing the bewitched is noted,[47] with the addition on one that the bowl can make others agreeable (*qabūl*) and obedient (*ṭā'ah*). On one of the bowls supposedly made for Saladin it is said that one should sprinkle water from it on a house that has been the object of sorcery.[48]

Nine bowls, including the two made for Ibn Zangi (see cat.25) recommend their use to cure the abdominal pain of a horse which has eaten earth.[49] Other, non-medical, uses of the vessels occur only once: for instance, the use of a bowl will ensure that no lion or wolf will turn upon the user, or it will increase his daily income and means of livelihood. On some of the bowls purportedly made for Saladin, it is stated that the user can thereby gain easy access to princes and kings, can make peace between enemies, and can prevent houses from being robbed or burnt or ships from being wrecked.

As in the earliest written references mentioned above, the inscriptions engraved on many of the early hemispherical bowls instructed the patient to drink water from the bowl to receive the desired benefit. Sometimes the afflicted person, or someone acting as an agent for him or her, was told to drink three times from the vessel. Occasionally, a specific type of water was indicated, such as rain water, water from the Nile, hot water, or saffron water, the latter being especially good for difficult childbirth. In the case of nosebleeds, the water was to be snuffed or inhaled. Sometimes other liquids were recommended, such as oil (*zayt*) or milk (*laban*), both mentioned on bowls in the Khalili Collection (see cat.25, 26 and 28).

Some of the early types of magic-medicinal bowls may have been put to yet other uses. Ibn Khaldun, writing in the 14th century, mentions among the diviners those who 'gaze into transparent bodies, such as mirrors and bowls of water'.[50] A modern account relates an Indian practice of writing a particular 3 × 3 magic square on a porcelain or copper bowl, filling it with water, and having a child look into it in order to see visions of the future or the unknown.[51] The artefacts themselves, however, provide no evidence for such use.

Later magic-medicinal bowls

Later magic-medicinal bowls took other forms than those already examined. One of these is exemplified by cat.27,which is shallow with a flattened bottom and a wide rim. It may be a Syro–Egyptian product of the 14th or 15th century, although the only other shallow plates appear to be late Safavid or Qajar work.[52] It has no therapeutic instructions nor animal representations, a magical square (but not a true magic square) being the focus of the

design. It also bears an invocation to Sham'alawi, a good spirit, which is relatively unusual on Islamic magic bowls, although invocations to archangels do occasionally occur.

From the 15th century onwards, it appears that one of the most common forms of magic bowl had a boss in the centre. The bosses are either rounded, conical or flat on top, and it has been suggested that they derive from the Graeco-Roman *omphalos* or umbo of wine vessels.[53] Bowls of this shape tend to be devoid of animal figures and, with only one exception, they lack a list of therapeutic uses.[54] Qur'anic verses usually form the principal decoration. This style of magic bowl has been erroneously termed a 'fear cup', based upon 20th-century folkloric practices studied by anthropologists, in which a person might drink from a bowl in times of trauma and terror.[55] It is unwise, however, to extrapolate backwards from modern accounts when there is no corroborating evidence. Certainly, on the only known example of this type which lists its uses, fear is not mentioned.

Thirteen of the known magic bowls with a central boss are clearly work from Safavid Iran.[56] The dating and provenance of the others is more difficult. Generally speaking, those with large rounded or flattened bosses appear to be products of the 15th to 17th centuries and range in provenance from Syria and the Jazirah to Mughal India.[57] Later bowls, probably made from about the late 17th century until the present day, tend to be smaller and have conical bosses. The calligraphy is often very poor, and most of them, but not all, were made for Shi'i communities. They appear to have been produced, or at least were marketed, over a wide area – Egypt, Saudi Arabia, Turkey, Qajar Iran, Afghanistan – but examples found across this area are virtually indistinguishable in design.

On some of these recent products, a small circular plate or cup with holes around the edge is attached to the central conical boss. Attached to the holes are small metal tags with writing on them, usually the *basmalah* or some of the *asmā' al-ḥusnā*, written in a very casual script.[58] Occasionally a metal bird, fish or even an amulet in the form of a human hand is attached to the conical boss. Sometimes, rather than being attached to the central elevation, the tags are grouped on a cord attached to the rim of the vessel.[59] Of the 41 later bowls with conical bosses that have been examined or are recorded, 12 have a central circular plate to hold lugs.

Three Safavid magic bowls with central bosses are dated. The earliest was completed by a maker named Husayn Kashani on 27 Ramadan 960 (5 September 1553).[60] It bears no animal or zodiacal forms, but rather Qur'anic texts, Shi'i prayers, and wishes for 'good health' engraved around the maker's name on the underside of the bowl. The calligraphy and general form of the bowl bear some resemblance to one of the undated Safavid bowls in the Khalili Collection, cat.31.

The other two dated Safavid bowls were finished within two years of one another and are so similar in design that they must have come from the same workshop. The earlier bowl was completed by an unnamed maker in AH 1042 (AD 1632),[61] while the second one, cat.30, was finished in AH 1044 (AD 1634–5). The inscriptions on the earlier bowl appear to provide interesting information about the length of time required to produce such a fine piece of metalwork, for it is said that the bowl was begun on 1 Rajab 1038 (25 February 1629) and completed on 17 Rabi' I 1042 (2 October 1632), taking three and a half years to produce. It may be, however, that this extravagant claim was made to enhance the value of the item. The latter magic bowl, produced for the Twelver Shi'i community, is an impressive example of Safavid metalwork, with emblematic representations of the zodiacal houses and the seven classical planets. Three similar bowls, all of outstanding design and execution, may have been produced in the same workshop as the two dated examples.[62]

Only two magic bowls with bosses that are clearly not Safavid products are known to be dated: one in AH 956 (AD 1549) or possibly AH 989 (AD 1581), by an engraver (*naqqāsh*) named Ibrahim,[63] and one in AH 1271 (AD 1855).[64]

Safavid magic bowls have received relatively little scholarly attention, but they are well represented in the Khalili Collection. All but one of the examples with bosses that are catalogued here are Safavid products made for Shiʿis: the exception, cat.34, was produced in India by an otherwise unknown maker, Ali Rida'.

Two of the bowls in the Collection were made for Sufi communities in the first half of the 17th century. One, cat.33, was made in AH 1050 (AD 1640–1) for the Qadiriyyah order. Of three metal magic-medicinal bowls from north-west India of the 17th to 19th centuries, two were clearly made for Shiʿis (cat.36 and 37), while the third is non-sectarian in the choice of its inscriptions (cat.38). None of the three bears any magic squares or sigla. They appear to be similar to two bowls said to have been made in Bedar and used for colic and in confinements.[65] Their method of construction is markedly different from that of the other metal bowls, in that the inscriptions were part of the casting.

All the metal bowls show clear signs of having been smoothed and polished on a lathe, for there are usually indentations at the centre of both the exterior and interior surfaces, or on top of the boss. Occasionally some surface treatment of the alloy is also evident, as in cat.28 or 36, where the colour of the surface may be due to the alloy containing some silver. On one item made in India, cat.34, the word *haft-jūsh* was inscribed by the maker on the underside of the bowl. The term is used today by Iranian metalworkers for what is a high-tin bronze, forged and quenched, though traditionally they claim it to be an alloy of seven metals, usually copper, silver, tin, antimony, lead, gold and iron.[66] So far as is known, this is the only preserved piece of metalwork to have the word *haft-jūsh* engraved on it. High-tin bronze has a silvery appearance and is a brittle alloy that cracks easily. The alloy of this particular bowl, however, has a reddish cast with no evident cracks. *Haft-jūsh* was also associated with magical objects, possibly because of its relationship with seven elements. Whether the word was inscribed on this bowl to designate its alloy or whether it had a magical purpose can only be settled by a determination of its elemental composition through a metallurgical examination.

Although the majority of extant magic-medicinal bowls are made of metal, there are examples in other materials. A small agate Shiʿi magic bowl (cat.35), with a delicately etched design, was made in AH 1014 (AD 1606), in India. No similar piece has been recorded. A considerable number of bowls, however, were made of Chinese porcelain, and these are discussed separately, below.

In summary, then, the numerous Islamic magic-medicinal bowls preserved today demonstrate that both shape and decorative motifs evolved over the centuries of their production. The earliest types (and those bowls copied from them) exhibit a relatively simple hemispherical form, engraved with some magical symbols, and nearly always have specified therapeutic uses. With time, the shape of the bowls became more sophisticated, the therapeutic statements were abandoned, and Qur'anic texts dominated the design, leaving few overtly magical symbols. In this way, the pre-Islamic folkloric traditions that first informed the decoration of these bowls were gradually replaced by texts and images more acceptable to orthodox religious belief.

1. Bodleian Library, Oxford, MS.Marsh 663, p.274, written in the same hand as the rest of the manuscript, which was copied in AH 640 (AD 1242) by Ibrahim ibn 'Abd al-'Aziz ibn 'Abd Allah ibn 'Ali ibn 'Adnan Sibt 'Umar ibn 'Abd al-'Aziz ibn Marwan. The magical formula is very similar to that occurring on the 'poison cups' discussed below.
2. Sanawbari, p.191; see also Dols 1992, p.285. The magic square that Sanawbari specified was one he called 'the seal [*khātim*] of al-Ghazali', which was the 3 × 3 magic square called *budūḥ*; see the essay on talismanic charts and shirts, pp.106–107. For modern uses of earthenware and metal magic-medicinal cups, see Lane 1836/1908, pp.260–61; Walker 1934, pp.69–70; Kriss & Kriss-Heinrich 1962, p.129.
3. More than 72 such earthenware magic bowls have been found inscribed in Jewish Aramaic, 33 in Mandaic and 21 in Syriac. All were made in Mesopotamia or Iran sometime between the 4th and 7th centuries. Many were unearthed in an inverted position, and a number were found in pairs joined with bitumen at the rim to form a closed container. One of the most common theories regarding their use is that they were demon traps: Montgomery 1913; Yamauchi 1967; Hamilton 1971; Isbell 1975; Naveh & Shaked 1985; Gager 1992, pp.226–32.
4. Reich 1938.
5. Ispahany 1991, pp.25, 38, 120, 121 and 162.
6. Dhahabi, p.166 (margin). There has been much confusion regarding the authorship of this treatise since Elgood (1962) mistakenly translated it under the name of the 15th-century theologian al-Suyuti. The recent English translation continues this error (see al-Suyuti, especially p.169). For the two versions of Dhahabi's treatise and their relationship to al-Suyuti's writings, see Savage-Smith 1995, pp.73–4.
7. In addition, there should be included in this general category one flat-bottomed bowl that otherwise meets the criteria (present location unknown, sold at Christie's, London, 22 October 1992, lot no.156), and one Jaziran stem-cup with a fictitious attribution to Kafur the Ikhshidid and the date AH 428 (AD 1036–7); Geneva 1985, no.284). Five, clearly later, hemispherical bowls have schematic animal forms but lack a list of uses, while two others, also rather recent, have neither uses nor animal forms.
8. The bowl, whose present location is unknown, was published with a lithographed reproduction by Rehatsek (1878, pp.204–211).
9. The present location of this bowl is unknown; see Spoer 1935, pp.254–6.
10. Other examples include a bowl dated AH 432 (AD 1041) and said to have been made for the Mamluk ruler al-Mansur Husam al-Din Lajin (d. AH 698/AD 1299); Wiet 1932, pp.12 and 164. Another bowl dated AH 506 (AD 1112) is stated to have been made for the Hamdanid ruler of Syria Sayf al-Dawlah (d. AH 356/AD 967); Wiet 1932, pp.54 and 164. One dated AH 535 (AD 1141) presents a fantastic and impossible genealogy for its patron; Wiet 1932, p.101.
11. Reinaud 1828, II, pp.337–3 and pls V and VI; Zéki Pacha 1916; Wiet 1932, p.95 and pl.LXII, pp.151, 166–8 and 271; Canaan 1936, pp.110–11; a bowl in the Harari Collection, inv. no.369 (unpublished, photographs available for study); another in the Museo Nazionale del Bargello, Florence, inv. no.Bronzi 316 (Florence 1981, pp.22–4); and two in the British Museum, London, Department of Oriental Antiquities, inv. nos OA2158 and 1991.10–26.9 (both unpublished).
12. For instance, 'copied from an example in the treasury of al-Ma'mun'; see Wiet 1932, pp.121, 176, 185.
13. Another bowl, whose present location is unknown, is dated AH 571 (AD 1175–6) and states in the inscription that it was made for al-Musta'sim bi'llah Abu al-'Abbas Zahir, which has been interpreted as a reference to a descendant of a Fatimid caliph (Cassanova 1891; see also Wiet 1932, pp.54 and 166 for objections to Cassanova's arguments).
14. For items bearing Baybars' name, see Wiet 1932, pp.54, 173, 174, 176 and 185; for one perhaps referring to a Rasulid ruler, see Wiet 1932, pp.54 and 150. A later Rasulid ruler, al-Mujahid al-Mansur 'Ali (d. 1363) may be intended as the patron named on another bowl (see Wiet 1932, pp.54 and 151).
15. See Wiet 1932, p.121 and pl.LX; the interior is badly worn and virtually illegible. A similar inscription and design are found on an unpublished bowl in the Science Museum, London, inv. no.A639330, which may be a fairly recent copy.
16. See, for example, Rehatsek 1873, pp.150–54; Ittig 1982.
17. See Canaan 1936, p.105; Ittig 1982, p.82.
18. For example, 'reproduced from [an example] in the royal treasury of al-Malik al-Mansur' (Wiet 1932, p.156); or copied from one in the fortress of 'the protected city of Damascus' (Canaan 1936, p.106, no.4, and the catalogue of a sale at Christie's, London, 20 October 1992, lot no.152).
19. The bite of a mad dog is mentioned 59 times, scorpion stings 56 times, and snake bites 54 times. The bite of a mad dog (*'aḍḍat al-kalb al-kalib*) occurs 10 times and *al-kalb al-kalib* alone, 49 times. The sting of a scorpion (*las'at al-'aqrab*) is mentioned 45 times, the bite of a scorpion (*qarṣat al-'aqrab*) once, and *'aqrab* alone 11 times. The sting of a serpent (*las'at al-ḥayyah*) is named 44 times, and *ḥayyah* 10 times.
20. Two bowls state they offer protection from all other creeping and crawling things (*li-sā'ir al-dabābāt*) and two that they can be employed to kill such a thing (*wakz al-dabīb*). One specifies the killing of lizards (*qatl al-wazagh*), and two mention their usefulness against *hawāmm*, which means any creature that has a poisonous bite, including insects, scorpions and reptiles (see the essay on talismanic plaques and mirrors, p.124, and p.125, note 5).
21. *Qawlanj*, mentioned 55 times. Canaan (1936, p.113, n.116) argues that *qawlanj* denotes a more

specific complaint, ileus, or obstruction of the intestine.
22. *Maghaṣṣ,* mentioned 37 times; *khilṭ bārid*, four times; and *waj' al-karsh* once.
23. *Waj' ra's al-qalb*, often written simply as *waj' al-qalb*, mentioned eight times.
24. *Maghl,* mentioned 16 times; Canaan 1936, pp.112–13, n.114.
25. *Riyāḥ,* mentioned twice. For the term *riyāḥ al-shawkah* that occurs on four bowls, including cat.25, see the discussion of this piece below, note 5.
26. *Istisqā'*, mentioned once.
27. *'Usr al-būl*, mentioned seven times.
28. *Bawāsīr*, mentioned twice.
29. *Li-l-ma'id.*
30. On the Jaziran stem-cup with the fictitious attribution to Kafur the Ikhshidid (see above, note 7), the curious term *khamūm*, possibly meaning putrefaction, is used, though in what sense is not clear.
31. *Muṭallaqah* (a woman in labour), mentioned 51 times, *'usr al-walad* (a difficult childbirth) mentioned 10 times, and *al-bint al-mu'sarah* (a difficult labour), mentioned 5 times. *Khabālah* (delirium associated with a difficult birth) is mentioned once.
32. *Maghlah*, mentioned 26 times, and *maghl al-ḥalab*, mentioned once. The word *maghlah*, when following the mention of a woman in labour or a difficult labour, appears to mean increasing the milk of a nursing mother. When the word modifies *faras*, the word for horse, it appears to refer to abdominal pain suffered by a horse that eats earth. See Canaan 1936, pp.112–13, n.114.
33. *Nakd al-aṭfāl.*
34. *Sabāq al-ḥabal.*
35. *Shaqīqah* (migraine), mentioned 39 times, *ṣudā'* (a general term for headache), five times, and *waj'al-ra's* ('pain of the head'), four times.
36. *Ḍarabān*. Spoer (1935, p.256) incorrectly translated this term as 'plagues'.
37. *Waj' al-ḍirs .*
38. *Ru'af* is mentioned seven times and *qaṭ' al-ru'af* six times.
39. *Ramy al-dam* (discharge of blood), 33 times, *qaṭ' al-dam* (stopping bleeding), once, *qaṭ' al-nazīf* (stopping haemorrhage or fluxes), three times, and *nazīf*, twice.
40. The word *al-quwwah* ('physical strength'), occurring 15 times, is often confused with the word *laqwah* or *lawqah* ('facial paralysis'). *Laqwah* occurs once, *lawqah* and *li-rādd al-lawqah* five times each. See Canaan 1936, p.113, n.120 and p.114, n.125.
41. For colds and catarrh, the term *nazlah* occurs six times in inscriptions on bowls, including those on cat.25 and 26; see note 4 of the discussion of cat.25. For epilepsy, *maṣrū'*, which can also mean madness, occurs once, while the awakening of an epileptic (*ifāqat al-maṣrū'*) is mentioned eight times. See Dols 1992, p.276 *et passim*.
42. *Ramad* ('opthalmia') on four bowls and *raf' al-ramad'* ('curing ophthalmia'), on one.
43. These are splenic fever, mentioned 16 times; hepatic fever, 17 times; phlegmatic fever, once; cold fever, once; hot and cold fevers, once; hot and malignant fever, twice; cold and malignant fever, twice (including cat.28); and the general 'sting of fever', five times.
44. *Li'l-ḥabb allatī ta'lū 'alā al-jasad* and *li'l-ḥumrah wa-li'l-jamr*.
45. Only 16 bowls have the two inscriptions in common. On 20 of the 23 bowls where the word *'ayn* occurs, including cat.25 and 26, it is immediately followed by *al-nuẓrah*, literally meaning sight or vision, which Wiet interpreted as a reference to the evil eye. Canaan, among others, however, has translated *al-nuẓrah* as 'improving sight', and such a translation would encourage a medical rather than magical interpretation of the word *'ayn*. This reading is supported by the occurrence on four bowls, including cat.25, of the word *ramad*, ('ophthalmia'), immediately following the word *nuẓrah*.
46. The word *arwāḥ* is so translated by Canaan (1936, pp.105 and 114). In one occurrence the reading itself is questionable. Spoer (1935, p.256) translated the word as flatulence, and indeed its occurrence in two instances in the midst of a list of gastro-intestinal complaints and haemorrhoids would support its interpretation as a variant of *riyāḥ* ('flatulence'). See also note 6 to the entry for cat.25.
47. *Ḥall al-ma'qūd* ('unbinding the tied'). The word *ma'qūd* means one who is bound with knots, a commonly used term for a person on whom a spell has been cast. The concept of binding spells whose knots must be unloosed is an ancient one, referred to in the Qur'an (CXIII, verse 4). For binding spells in antiquity, see Gager 1992.
48. *yarushsha minhā al-bayt idhā sāwama al-siḥr*.
49. *Al-faras al-maghlah* or, in two instances, *al-faras al-mamghūl*. See Canaan 1936, pp.112–13, n.114.
50. Ibn Khaldun, I, p.186; see also Ibn Khaldun–Rosenthal, I, p.216, where the phrase *al-marāyā wa-ṭisās al-miyāḥ* is translated as 'mirrors, bowls, or water'.
51. Thomas 1905, p.51. For the *budūḥ* square, see the essay on talismanic charts, pp.106–107.
52. Ann Arbor, MI, Hatcher Graduate Library, Department of Rare Books, inv.no.GL-5; Science Museum, London, Wellcome Collection, inv.nos A155166, A639325, A155167 and A163697; only the last item has been published. See also Fodor 1990, p.167, no.309.
53. Allan 1986, pp.42–7.
54. The exception is described by Canaan (1936, p.108 no.9). Only three such bowls are known to bear animal figures: Musée de l'Institut du Monde Arabe, Paris, Destombes Coll.21 (see Mouliérac 1989, pp.122–3); Ann Arbor, MI, Hatcher Graduate Library, Department of Rare Books, inv.no.GL-7, unpublished; and that auctioned at Christie's, London, 19–21 October 1993, lot no.368.
55. For example, see Zwemer 1920, p.179; Canaan 1923; Walker 1934, p.69; and Maloof 1979, pp.139–140.
56. These include cat.30, 31, 33 and 34. See also the bowls sold at Christie's, London, 20 October 1992, lot nos 155 and 158, present locations unknown; private collection, London; Science Museum, London, Wellcome

Collection, inv. nos A128451, A129017, and A639333; Brooklyn Museum, New York, Department of Asian Art, inv. no.73.52.1; Rehatsek 1874a, present location unknown; Victoria & Albert Museum, London, Department of Metalwork, inv. no.780–1889 (Melikian-Chirvani 1982, pp.290–92, item 125); British Museum, London, Department of Oriental Antiquities, inv. no. 1902.8–12.1.

57. About 15 of this sort have been observed or are recorded in the literature. For one assigned to Syria or the Jazirah of the 15th to 16th century, see Allan 1986, p.108; for an undated Mughal example, see Roşu 1992.

58. These tags or 'keys' no doubt gave rise to a practice referred to by 20th-century writers: Zwemer (1920, pp.182–3) describes the placing of ordinary keys in a magic bowl, covering them with water and letting them stand for a while before drinking the water, and comments (p.179) on the potential effect of the oxide of iron on the patient.

59. In one instance, a Safavid bowl of the mid-17th century, holes were drilled at regular intervals around the rim of the bowl and a tag attached at each point; Science Museum, London, Wellcome Collection, inv. no.A128451, unpublished. The tags may well have been added sometime after the manufacture of the bowl: they could never have been immersed in the water while in this position.

60. Sold at Christie's, London, 20 October 1992, lot no.158; present location unknown.

61. Sold at Christie's, London, 20 October 1992, lot no.155; present location unknown.

62. London, Science Museum, inv. no.A128451; Brooklyn Museum, New York, Department of Asian Art, inv. no.73.52.1; and one in a private collection in London; all three are unpublished.

63. See Wiet 1932, p.77; Zéki Pacha (1916, p.244) reads the date as AH 989 (AD 1581).

64. Private collection, Oxford; unpublished.

65. Ismail 1921; unfortunately no photographs or drawings were provided.

66. Allan 1979, p.51.

25

Magic-medicinal bowl

Syria, dated AH 565 (AD 1169–70)

Copper alloy, cast and turned
height 7.5 cm
maximum diameter 19.0 cm
accession no. MTW 1443

This is the second oldest reliably dated Islamic magic-medicinal bowl known. The oldest was made two years earlier, in AH 563 (AD 1167–8), for the same patron, Nur al-Din Mahmud ibn Zangi, who ruled in Damascus from 1146 to 1174.[1]

The bowl is hemispherical with a slightly everted rim. It has a dark finish and white infilling in the engraving. On the outside of the bowl, beneath the rim, a circular inscription reads, 'This blessed cup is for every poison. In it have been gathered proven uses, and these are for the sting of serpent, scorpion and fever, for a woman in labour, the abdominal pain of a horse caused by eating earth,[2] and the [bites of] a rabid dog, for abdominal pain and colic, for migraine and throbbing pain, for hepatic and splenic fever, for [increasing] strength, for [stopping] haemorrhage, for chest pain, for the eye and vision [evil eye],[3] for ophthalmia and catarrh,[4] for *riyāḥ al-shawkah*, for [driving out] spirits,[5] for releasing the bewitched, and for all diseases and afflictions. [If] one drinks water or oil or milk from it, then they will be cured, by the help of God Almighty. It was prepared [while] the sun was in Leo and engraved for the sultan al-Malik al-'Adil Mahmud ibn

25, detail of inscription

Zangi in the year 565.'

Beneath this dedicatory inscription, and separated from it by a plain fillet, is a broad band filled with 14 lines of magic writing apparently overlaid by three narrow, interwoven bands.

On the underside of the bowl a ring of magic script encloses a blank fillet which in turn encloses nine lines of magic writing, now so worn as to be scarcely legible. The significance of the letters, numerals and symbols here is not apparent.

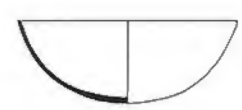
On the inside of the bowl, immediately beneath the rim, there is another line of similar magic writing. Beneath it, a broad panel and the nine medallions within it are defined by the undulations of a continuous plain fillet against a ground of magic writing. The interior is badly worn through extensive use so that only faint traces of the writing and the figures within the medallions are now legible. One circle appears to contain a human figure, possibly a pregnant woman, sitting cross-legged with arms down at the sides. Other medallions contain a second schematic human figure, with one hand raised and pointing to his head; a scorpion; traces of what may have been intertwined serpents; a four-legged animal; and a square tablet of magic writing. Similar writing fills part or all of the remaining three medallions. The rest of the interior of the bowl apparently contained other medallions and rings enclosing writing, which are all virtually obliterated.

The style of the magic writing and the nature of the dedicatory inscription, though shorter, is very similar to that on the earlier bowl made for Nur al-Din ibn Zangi, though the latter is slightly larger. On the earlier magic bowl the circles containing figures are engraved on the outside of the bowl, not the inside, and are seven in number rather than nine. Moreover, this bowl is inscribed with various Qur'anic verses and a statement, placed near the circle containing a cross-legged human figure, that 'a pregnant woman will be delivered of her child safely, by the permission of God Almighty, for with difficulty there is ease'.[6]

The significance of one of the phrases in the dedicatory inscription, *riyāḥ al-shawkah* (literally 'winds of prickles'), is unclear. Rehatsek renders it as 'fluxes',[7] while Canaan and Spoer translate it as 'whitlow',[8] a painful ulceration near a fingernail or toenail, apparently considering it equivalent to the phrase *rīḥ al-shawkah* that the lexicographers have translated as whitlow.[9] The 19th-century Egyptian writer on folk medicine in Egypt, 'Abd al-Rahman Isma'il, used the term *shawkat al-rīḥ* ('thorn of the wind') for ulceration of the fingers and toes.[10] Wiet interprets *rīḥ al-shawkah* as 'peste' or plague,[11] apparently following Lane and his sources, who give *shawkah* as a synonym of *ṭā'ūn*, a common word for plague and pestilence; Lane added that *shawkah* can mean redness on the skin following a scorpion bite, which could be alleviated by charms or spells.[12] There are problems with all these interpretations, however, for *shawkah* does not occur in the numerous plague tracts that have recently been given scholarly attention,[13] and the term for a whitlow in the medical literature is *dāḥis*.[14]

The phrase occurs on only three other bowls: on that made for Ibn Zangi in AH 563 (AD 1167–8), where it is also apparently written without diacritical points;[15] on a bowl dated AH 570 (AD 1174–5) and allegedly made for al-Mansur Asad al-Din Shirkuh;[16] and another bowl with a suspect date of AH 606 (AD 1209–10), allegedly made for al-Mu'tamid billah.[17] The occurrence of the expression *riyāḥ al-shawkah* on these four magic bowls indicates that it was a popular term in Syria and Egypt during the 12th and 13th centuries for some ailment which might be an ulcerated skin disorder, or could simply refer to the effects of hot, sand-laden winds, or even to the stinging effects of the activities of *jinn*, which were sometimes associated with plague and pestilence.[18]

1. Rehatsek (1878, plate between pp.204 and 205) published a lithographed drawing of the outside of the bowl, and misinterpreted the date given in *abjad* letter-numerals as 463, reading a *tā'* instead of a *thā'*. In attempting to correct this error, Ittig (1982, p.81, n.2) introduced another by giving the letter *sīn* the value 40 instead of 60 and reading the year as AH 543. The bowl's present location is unknown.
2. *Al-faras al-maghlah*; see Canaan 1936, pp.112–13. n.114.
3. *Al-'ayn wa'l-nuẓrah*. See p.80; note 45, above.
4. *Al-ramad wa'l-nazlah*. In the ophthalmological literature the former term refers specifically to ophthalmia, but can be used generally for any inflammation and congestion of the eye. The latter term refers to discharges and rheums in general as well as congestion of the eyes or any general inflammation of the respiratory organs. See Canaan 1936, p.114, n.121; and Savage-Smith 1980, p.187.
5. *Arwāḥ* is translated as 'malicious spirits' by Canaan (1936, p.114), though Spoer (1935, p.256) translates it as 'flatulence' and Rehatsek (1878, p.205) as 'winds'. It occurs on the same four bowls as the term *riyāḥ al-shawkah*, and on one attributed to Baybars and dated AH 641 (AD 1244), now in the Louvre, Paris (see Wiet 1932, pp.53 and 57, where he leaves the term untranslated).
6. The Qur'anic verses are from the surahs *Āl 'Imrān* (III, verses 18–19), *Yūnus* (X, verses 57 and 81), *al-Ra'd* (XIII, verse 11), *al-Naḥl* (XVI, verse 78), *Banī Isrā'īl* (XVII, verse 82), *Ṭā'-hā'* (XX, verses 17–21 and 46), *al-Shu'arā'* (XXVI, verses 78–80), *al-Ṣāffāt* (XXXVII, verses 75–82), *Ṣād* (XXXVIII, verse 33), *al-Mu'min* (XL, verses 18–21), *al-Takwīr* (LXXXI, verses 14–20) and *al-Inshiqāq* (LXXXIV, verses 1–4). There is also a small 3 × 3 magic square, with the common sum of 15, in one of the circular medallions containing a winged animal. See Rehatsek 1878, pp.206–9.
7. Rehatsek 1878, p.205.
8. Canaan 1936, p.114; Spoer 1935, p.256.
9. Dozy 1881, I, p.804; Hava 1951, pp.277 and 383.
10. Walker 1934, p.67.
11. Wiet 1932, p.57.
12. Lane 1863/1908, pl.4, p.1621.
13. For example, Dols 1977, pp.315–19.
14. Zahrawi, pp.590–91.
15. Rehatsek 1878, plate between pp.204 and 205.
16. Present location unknown; see Spoer 1935, p.255 and above, p.73.
17. Harari Collection; Wiet 1932, pp.53, 57.
18. Conrad 1992, pp.85–7.



25

26

26

Magic-medicinal bowl

Perhaps the Jazirah, mid-13th century

Copper alloy, cast and turned
height 8.2 cm
maximum diameter 20.1 cm
accession no. MTW 189

In its size, form and the style of magic writing of its inscriptions, this hemispherical bowl is similar to that made for Ibn Zangi, cat.25, although the metallic surface has a rosy colour and the engraving a dark infill, and there are consistent differences of detail in the script.

On the outside of the bowl, beneath the rim, there are two narrow lines of magic writing, with a broader band between them which carries an inscription: 'This blessed cup neutralizes all poisons. In it have been gathered proven uses, and in it are verses of healing from the Book of God the Powerful. It is [useful] for the sting of serpent, scorpion and fever, for a woman in labour and increasing milk [of a nursing mother],[1] for the [bites of] a rabid dog, for abdominal pain and colic, for migraine and throbbing pain, for hepatic and splenic fever, for [increasing] strength, for [stopping] haemorrhage, for chest pain, for toothache, for catarrh, for the eye and vision [evil eye],[2] and for all diseases and afflictions. [If] the afflicted person or their agent drinks oil or water or milk from [it], then they will be cured, by the help of God Almighty. By order of the Imam al-Musta'sim bi'llah Muhammad al-Baqir while the moon was in the House of Scorpio [in the] year 502.'

In fact the date given, AH 502 (AD 1108–9), is almost 150 years before the reign of the Abbasid caliph al-Musta'sim bi'llah (1242–1258). Since he is clearly named, the bowl cannot have been produced before the middle of the 13th century. We can conclude either that the bowl was made for him and the engraver made an error when incising the date, which is written out in words, or that the name and date are both incorrect and were added to a later object to give it a provenance. Another magic-medicinal bowl is recorded as bearing Musta'sim bi'llah's name and an incongruous 12th-century date, and it is possible that both objects came from the same workshop.[3] While the overall design and calligraphic style are similar to those on cat.25, the engraving and calligraphy are also very similar to the magic inscriptions on the only recorded magic-medicinal stem-cup, dated either AH 428 or 528 (AD 1036–7 or 1133–4) and bearing the name of Kafur the Ikhshidid, but which has been attributed to the northern Jazirah in the second half of the 13th century.[4]

In addition to specifying various conditions for which the bowl could be useful, the dedicatory inscription also refers to the Qur'anic verses which it carries. These are found about halfway down the inside of the bowl, and comprise the 'Throne Verse' (II, verse 255) followed by an unidentified short passage and concluding with surah X, verse 57. Above this band are seven concentric rows of magic writing, the top row separated from the other six by a thin blank fillet which curves down to form eleven semicircles overlaying the writing. Beneath the Qur'anic text there are five more lines of magic writing with 21 interlinking semicircles lying over them to produce an imbricated pattern. A few traces of Arabic, perhaps more Qur'anic verses, can be detected in the bottom of the bowl, but virtually all the engraving in the centre has been obliterated during years of use.

On the outside of the bowl, beneath the dedicatory inscription and its framing bands of magic script, there are 11 lines of magic writing apparently overlaid by a blank fillet forming contiguous loops. The underside of the bowl seems to have carried additional lines of magic writing, now virtually obliterated.

26, detail of inscription

1. See p.80, note 32.
2. See p.80, note 45.
3. The name is written as al-Musta'sim bi'llah Abu al-'Abbas Zahir and the date given is AH 571 (AD 1175–6). Its present whereabouts are unknown and only the transcribed inscription has been published. See Cassanova 1891, pp.323–30; Wiet 1932, pp.54, 166.
4. Geneva 1985, pp.274–5, no.284.

27

Magic-medicinal bowl

Eygpt or Syria, *circa* 1400

Copper alloy, cast and turned
height 4.2 cm
maximum diameter 20.0 cm
accession no. MTW 188

This shallow, flat-bottomed magic-medicinal bowl has a wide, everted rim. The large, carefully executed and fully vowelled inscriptions are filled with a black substance which now appears white in most areas, probably due to cleaning, making them very readable against the dark metallic alloy, which has a silvery cast. There is relatively little sign of wear on the inside of the vessel although there is pitting of the surface and traces of aggressive cleaning. No date or patron's name appears on it, and no magic-medicinal bowl of comparable design is recorded. The general nature of the metalwork and inscriptions, however, suggests that it might have been made in Syria or Egypt in the late 14th or early 15th century.

The bowl bears no engraved therapeutic instructions nor any animal representations. The exterior is covered with Qur'anic verses, but the focus of attention is a large talismanic square at the bottom of the bowl. This is an 8 × 8 magic square whose horizontal and vertical lines have the letter *hā'* at either end, except for four near each corner which begin with the numeral three. Letters of the alphabet, especially *hā'* and *ṭā'*, and magical symbols occupy the cells. The symbols are arranged so that the resulting figure is neither a true magic square nor a Latin square nor a verse square.[1] Except for the two cells at the left-hand end of the bottom row, which contain the words *barakah lanā* ('a blessing on us'), the significance of the magic letters and symbols in the talismanic square is undetermined.

On the curved inner surfaces of the bowl, surrounding the square, blank semicircular bands interlock to form a six-lobed star or flower figure. Four concentric rings of prayers, with the occasional use of Qur'anic words and phrases, all fully vowelled as if to be read aloud, are inscribed on the ground behind this figure. The 'Throne Verse' (II, verse 255) is inscribed on the upper surface of the rim, beginning above the top of the talismanic square.

On the underside of the rim are inscribed a quotation from the surah *al-Kāfirūn* (CIX, verses 1–9) followed by the whole of the surah *al-Ikhlāṣ* (CXII). Beneath the rim a row of ten truncated pentagonal cells contains verses 1–6 from the surah *al-Fatḥ* (XLVIII). The areas above the cells are filled with magic ciphers. Beneath this, two concentric bands of inscriptions contain the surah *al-Falaq* (CXIII) followed by *al-Nās* (CXIV), concluding with invocations reading, 'The light obeys, O Sham'alawi,[2] O his master, O his representative, O his lord, Who is the Living One, the Eternal. O the Enduring One .... Come, ... , come.[3] Majesty belongs to God. The Ruler is God. O God the [Divine?], Exalter of rank.'

1. For definitions of such squares, see pp.106–107, below.
2. The name of a good spirit.
3. In a similar invocation, the name *Sarāhīl*, apparently that of an unidentified angel – perhaps *Isrā'īl* – is written in place of what appears in this inscription to be *sh-r-ā hayyā*; see Canaan 1936, p.87. For angels' names in general, see Canaan 1937, p.81–3.

27

28

Magic-medicinal bowl

Egypt or Syria, 13th–14th century

Copper alloy, cast and turned
height 3 cm
maximum diameter 10 cm
accession no. MTW 526

The walls of this small, shallow, hemispherical bowl have become slightly deformed, and the engraving on the underside as well as at the bottom has been badly worn. Two small plugs appear to be repairs to fill holes that were drilled in the bowl at some time. The dark, silvery colour of the surface may be due to the alloy of which the bowl is made containing some silver; the bowl is quite heavy for its size. With the passage of time some of the copper may have leaked away leaving behind a silver-enriched surface which has tarnished.

No date or patron's name occurs on the bowl, but it does provide a list of therapeutic uses. Although the bowl is smaller than usual, its design has elements typical of magic-medicinal bowls that appear to be 13th- or 14th-century products, probably from Syria or Egypt.

On the outside of the bowl, near the rim, a band of Arabic writing reads, 'This blessed cup neutralizes all poisons. In it have been gathered proven uses, namely for the bite of serpent, scorpion and rabid dog, [for] a woman in labour, a headache, for [?],[1] increasing the milk of a nursing woman,[2] [increasing] strength, for a migraine, throbbing pain and for a cold and malignant fever. The one afflicted or his agent drinks water or milk or oil in it. [It is] true, tested and blessed.'

This inscription has several interesting features. The most striking is the lack of reference to God as the true agent for any cure brought about through the use of the bowl. The use of two different words for a headache, *ṣudā'* and *shaqīqah*, is also distinctive: the first term seems oddly placed, interrupting the list of conditions relating to childbearing, and might be a mistake; the latter is usually restricted to a hemicranial headache or migraine. The reference to a cold and malignant fever occurs on only one other recorded bowl,[3] which is similar in many other respects to this piece.[4] The expression probably refers to feverish chills as well as a fever that is potentially lethal. Also unusual is the failure to mention the gastro-intestinal complaints that are virtually ubiquitous on all other magic-medicinal bowls.

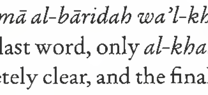
Beneath the inscription giving the bowl's therapeutic uses there is a band containing six medallions defined by a blank fillet. Each medallion contains five lines of writing with a further three lines in the spaces between the circles. Beneath this there is a ring of illegible Arabic script and, in the innermost ring, traces of engraved magic numerals. The base of the bowl is pitted and worn.

The inside of the bowl is of a rather complicated design, now quite badly worn. Next to the rim is a ring of magic writing and immediately under this a thin fillet that is blank except for four groups of magical numbers (62112/6153/692114/652114). In four places, the thin band curves down to form a circular medallion. Inside each of these medallions is an engraved design, once inlaid with silver and now difficult to read. In an anticlockwise sequence these are a scorpion with a prominent hook at the end of its tail and the numeral 62; a schematic rendering of a human figure with breasts and a big belly, sitting cross-legged, also accompanied by the numeral 62; a design composed of three rows of magical symbols and numerals, with what might be a snake in the top row and possibly another animal in the bottom row; and a schematic rendering, using small squares and geometrical forms, of another human figure, possibly kneeling with the arms folded over the chest or, perhaps, cradling a baby in her arms. A square containing Arabic text is placed between each of the circular medallions and the spaces between the squares and the medallions are filled with lines of magic writing. Reading anti-clockwise from the scorpion design, the squares contain magic words in a formula found on the so-called 'poison cups';[5] a quotation from the surah *al-Furqān* (XXV, verse 45); a quotation from the surah *al-Inshiqāq* (LXXXIV, verses 1–4), followed by the phrase 'and the pregnant woman delivers her child and is fertile'; and a quotation from the surah *al-Anbiyā'* (XXI, verses 69–70). The text from surah LXXXIV, verses 1–4, occurs on other early magic-medicinal bowls, and is usually accompanied, as here, by additional non-Qur'anic statements calling for the safe and easy delivery of a child. On this bowl it is placed next to the medallion containing the seated figure with arms crossed over the chest or cradling a baby.[6] This is probably intended to represent a nursing woman while the other figure represents a pregnant woman. Similar figures, as well as the scorpion, are found on other magic bowls of a fairly early date.

Further down the interior of the bowl another band appears to have carried an Arabic inscription that is now obliterated and four more circular medallions with engraved figures, the spaces between filled with magic writing. This area was once inlaid with silver and is now so worn that no details can be read.

The bowl which most closely resembles this example, and shares the reference to cold and malignant fever, was described by Rehatsek and reproduced in lithographed drawings.[7] Its interior is similar in layout to the inside of cat.28, with quotations from the surahs *al-Furqān* and *al-Inshiqāq* and a non-Qur'anic statement assuring safe delivery of a child occurring in two of the four textual areas. By contrast, however, the other two areas contain non-Qur'anic pious statements and invocations, the 'Throne Verse' appears near the rim, and only one abstract geometrical design is repeated in the circular medallions. The exteriors of the two vessels are similar, except for a small ring of magic letters near the rim of the item described by Rehatsek that is not on the Khalili bowl. The main point of difference between the two, judging from the lithograph, is the quality of engraving, which is finer on cat.28. All these features suggest that the slightly larger magic bowl described by Rehatsek might be a later copy of the basic design represented by the more carefully executed bowl in the Khalili Collection. In overall design and layout both bowls are similar to that made for the Mamluk ruler al-Mu'izz 'Izz al-Din Aybak.[8]

1. A plug in the bowl occurs at this point and obliterates the word.
2. See p.80 above, note 32.
3. *ḥummā al-bāridah wa'l-khabāthah.* Of the last word, only *al-khabā* is completely clear, and the final two letters could also be interpreted as a *rā'* and a *tā' marbūṭah*. On the comparative bowl the word for 'malignant' is written as *al-khabīthah*.
4. Present location unknown; Rehatsek 1873, p.159, no.4.
5. For this formula, see Ittig 1982, p.87; and Canaan 1936, p.103.
6. On the bowl made for Ibn Zangi in AH 563 (AD 1167–8) the quotation is also placed next to a cross-legged human figure and followed by additional phrases for the safe delivery of a child (present whereabouts unknown; Rehatsek 1878, p.208). See also Rehatsek 1873, pp.154, 158–9 and 161 (nos 2 and 4–6, undated); and Canaan 1936, p.104.
7. See note 4, above.
8. Wiet 1932, p.121 and plate LX; photographs were also available for study. The inside is now so worn that reliable readings cannot be made.



28, exterior

28, interior

29

Magic-medicinal bowl

Iran, 16th-century

Copper alloy, cast and turned;
a large crack has been repaired
height 5.1 cm *diameter* 18.3 cm
accession no. MTW 1378

This shallow hemispherical bowl, which has a flattened bottom, has been carefully executed in a metallic alloy with a dark finish and a silvery blue cast. No magic bowl of comparable design is recorded, but the artistic conventions it displays reflect those of the Qazvin school in the 16th century.

At the centre of the bottom of the bowl the anthropomorphized face of the Sun is shown encircled by rays. The treatment of the round face, with its double chin and hair rising to a point, is typical of 16th-century artists in Qazvin. An indentation made when the bowl was turned on a lathe hides the point where the nose should be. Surrounding the Sun are two rings of contiguous cells with ogival arches, twelve in each ring, arranged to form a double-petalled flower and enclosed by a band of text framed by two blank fillets. Both the cells and the circular band contain prayers and affirmations of faith, inscribed in densely written Arabic.

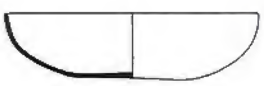
On the curved sides of the interior, two thin, slightly scalloped fillets interlace to form six large circular medallions and six small ones. Engraved within the smaller medallions are personifications of the remaining classical planets, all but the Moon being incised over grounds of spiralling vines and flowers. The Moon, placed to the left of the Sun, is represented by another facial type associated with the Qazvin workshops, surrounded by a pearl border. Proceeding anticlockwise from the Moon, the next figure is Jupiter, represented by a turbaned and robed male sitting with his left leg folded under him and reading from a book resting on his raised right knee. The next figure has been defaced by the repair to the crack, but the presence of a stringed instrument, which is still visible, indicates that it represented Venus. The following figure is Mars, represented by a running man wearing a conical hat or helmet and having five arms, one holding a sword and the others a scorpion, an axe, a dish and a severed human head. The next circle contains the figure of Mercury, a turbaned figure sitting cross-legged and holding an astrolabe, with a writing table behind him. Mercury is usually portrayed as a man in the act of writing, though there are some instances in manuscript illustrations where he is depicted with an astrolabe.[1] The last medallion contains a male figure representing Saturn; he is seated cross-legged, wears a hat and has seven arms carrying magical emblems that include a kid or lamb, a club, an axe and a net.

Prayers and invocations fill the large medallions and the spaces between them and the small medallions. Below the rim on the interior of the bowl a band is divided into six elongated cartouches containing the 'Throne Verse' and three other verses from the surah *al-Baqarah* (II, verses 255–8), beginning above the figure of Saturn and followed by prayers and pious phrases.

On the exterior of the bowl, another narrow band beneath the rim contains circular medallions enclosing the names of the zodiacal houses engraved on a ground of spiralling vines. The name of Aries (*ḥamal*) is inlaid with brass or, possibly, silver. Between the names of the signs elongated cartouches are inscribed with verses 1–18 from the surah *al-Fatḥ* (XLVIII), beginning after the medallion containing the name of Aquarius (*dalw*). Beneath this band, 12 circular medallions with scalloped profiles are formed by the interlacing of thin fillets, as on the interior; they are decorated at the top and bottom with flowerheads, with single straight fillets extending from the lowest points. The medallions contain emblems of the twelve zodiacal signs engraved over a ground of flowers and spiralling vines against hatching; each medallion is positioned under the corresponding name in the narrow band near the rim. Gemini is shown as a two-headed, male figure; Virgo, a kneeling turbaned man reaping corn with a scythe; Libra, a male sitting cross-legged beneath a pan-balance suspended above him; and Aquarius by a particularly fine representation of a man drawing water from a well. The zodiacal house of Leo is represented by a roaring lion in front of a large radiant Sun, a design illustrating that the Sun was most often associated with, or domiciled in, Leo. The house of Sagittarius contains a centaur shooting an arrow at his tail, which terminates in the head of a dragon, representing the 'pseudo-planet' or lunar node particularly associated with Sagittarius. The ground between the zodiacal medallions is covered with inscribed prayers and invocations, with an occasional Qur'anic passage such as that from the surah *Āl ʿImrān* (III, verses 16–19), written near the top of the medallion containing Virgo.

On the bottom of the bowl, now badly worn, there are five more medallions with prayers and other, indecipherable, material. On a sixth, shield-shaped, cartouche which has been damaged by the repairs to the crack, a single word can still be read, *naqqāsh* ('engraver'). Unfortunately the rest of the inscription is so worn or damaged that the date or the name of any maker or patron that might have been engraved there is now obliterated.

1. For example, an illuminated horoscope made for Iskandar Sultan, grandson of Timur, in AH 813 (AD 1410–11) in the Wellcome Institute for the History of Medicine, London, MS.Persian 474, folios 18b–19a (see Savage-Smith 1992a, pp.63–4 and pl.1; and Savage-Smith 1992b, pp.19–22); and an illustration in a 17th- or 18th-century copy of al-Qazwini's *ʿAjāʾib al-makhlūqāt* in the Walters Art Gallery, Baltimore, MS.593, folio 20a.



29

29

30

Magic-medicinal bowl

Iran, dated AH 1044 (AD 1634–5)

Copper alloy, cast and turned
height 7.5 cm
maximum diameter 22.0 cm
accession no. MTW 192

This carefully executed magic-medicinal bowl has a large, nearly hemispherical, central boss, an everted rim, and a low circular foot. There are traces of a black composition which was once inlaid in the engraving of the small inscriptions and the grounds behind the large inscriptions and the zodiacal and planetary figures that play a prominent role in the overall design.

The central boss and surrounding circular band are engraved with seven roundels containing personifications of the seven classical planets in their usual sequence (the Moon, Mercury, Venus, the Sun, Mars, Jupiter and Saturn); the last, Saturn, is engraved on top of the boss.[1] The Moon is represented by a circular disk within a ring of flowering vines. In a clockwise sequence, the next figure is Mercury, a seated, crowned man shown in the act of writing, against a ground of spiralling vines. Venus is a seated woman playing a stylized stringed instrument, also shown on a ground of spiralling vines. The Sun is a circular disk surrounded by rays.[2] The figure of Mars, also engraved on a ground of spiralling vines, is crowned and stands with a sword in one hand and a severed head in the other, while Jupiter is crowned and sits cross-legged while reading a book, with his right hand raised.

In three of the areas between the roundels – that is, between those containing the figures of Mercury and Venus, the Sun and Mars, and Jupiter and the Moon – the metrical Shi'i prayer beginning 'Call upon 'Ali, through whom miracles are made manifest' is inscribed in small script written upside down relative to the other inscriptions. The remaining three intervals contain inscriptions in larger script and engraved with a recessed ground. Most of these cannot be read, though one segment seems to have 'O 'Ali !' repeated several times. Around the top and bottom of the ring and on the sides of the boss, additional text is engraved in a small, tightly written script consisting of prayers and Qur'anic phrases, for example, 'And He has power over all things'.

The bowl's curved interior walls are also covered in densely written small script, some of which can be identified as prayers and Qur'anic verses, including part of the surah *al-Kāfirūn* (CIX, verses 1–2). The writing occupies the spaces between a network of thin scalloped fillets criss-crossing to form an imbricated pattern that covers the interior surface to within about three centimetres of the rim. The area nearest the rim is criss-crossed by bands to produce rectilinear areas of text, for instance, in the form of six-pointed stars.

The upper surface of the rim is engraved with the 'Throne Verse' and following verses from the surah *al-Baqarah* (II, verses 255–7), followed by text from the surah *Yā'-sīn* (XXXVI, verses 1–19), written in a cursive script. The underside of the rim, inscribed with a similar script, contains prayers seeking protection from, among other things, 'all afflictions' (*min jamī' al-āfāt*).

Immediately beneath the rim, on the outside of the bowl, is a band containing an inscription in large *nasta'līq* script on a hatched ground with spiralling vines. The inscription invokes blessing upon Muhammad and the Twelve Imams. Beneath this Shi'i formula there is a very wide band containing two mirrored rows (one inverted) of ogival arches, 24 in each row, which form 12 large medallions, and 12 pairs of small medallions. The zodiacal figures are represented in the large medallions, engraved on a ground of spiralling vines with flowers engraved over hatching. Leo is represented as a lion of rather unconventional appearance surmounted by a radiant, teardrop-shaped Sun, representing the Sun domiciled in Leo. The figure of Sagittarius has the lunar node of the dragon's head at the end of its tail, as on cat.29. The areas between and around these medallions, and in the interspersed small medallions, contain prayers and invocations, again written in a densely packed, small script.

Near the foot of the bowl another band of large, flowing script contains Qur'anic phrases, beginning beneath the figure of Aries with part of the surah *al-Naṣr* (CX, verses 1–3), followed by the surah *al-Ṣaff* (LXI, verse 13, lines 2–3). The foot itself is inscribed with prayers written in small, tightly packed script in six elongated cartouches. On the underside of the bowl, at the bottom of the cavity formed by the boss, the invocation *Yā ṣāḥib al-zamān* ('O Master of the Age!' or 'O Keeper of Time!') is written with the date, AH 1044 (AD 1634–5).[3] The invocation refers to the Twelfth Imam, Muhammad Mahdi, whose imminent return was promised.[4]

Four unpublished bowls are strikingly similar in design to this piece, though not identical.[5] On one, an inscription on the underside of the boss reads 'this bowl was begun on 1 Rajab 1038 (25 February 1629) and finished on 17 Rabi' I 1042 (2 October 1632)'.[6] All seven of the planetary figures, however, are shown in the ring around the boss rather than having Saturn on top of the boss, as is the case on cat.30 and three other similar bowls, all of which are undated. Two are quite similar to the Khalili example,[7] although there are differences in the design of the network of criss-crossing bands forming the cartouches and in the text in the bands containing the planetary figures. The fourth bowl also differs slightly in the bands enclosing text and medallions, with an additional slight variation in the placement of some texts.[8] So striking is the similarity among these five pieces, two of which were made within two years of one another, that it suggests that all were made in the same locality in Safavid Iran, and possibly in the same workshop.

1. The figure of Saturn has been all but obliterated through wear, but appears to be represented by a crowned and seated figure with six arms holding a crown, an axe, a club, a fish and two other unidentified objects. Such a figure is very clear on a similar bowl in the Brooklyn Museum, New York, Department of Asian Art, inv.no. 73.52.1 (unpublished), one of three related bowls that have the same arrangement of planetary figures.
2. On all the similar bowls discussed here, the disks of both the Sun and the Moon have engraved faces, which may have worn away on this example.
3. In the unusual numbering system used here, the zero is written as three vertical dots. A line under this numeral could be interpreted as the word *sanah* ('year').
4. See Halm 1991, pp.77–90.
5. The magic bowl described and illustrated by Rehatsek (1874a) has similar zodiacal figures on the outside, but in all other respects of design and text differs from this group of Safavid bowls.
6. Sold at Christie's, London, 20 October 1992, lot no.155.
7. Science Museum, London, inv. no.A128451, and a bowl known to be in a private collection in London as of January 1994. The Science Museum example is rather badly worn and corroded and has had a series of metal tags bearing the *basmalah* attached at intervals around the rim.
8. Brooklyn Museum, New York, Department of Asian Art, inv. no. 73.52.1.

30, exterior

30, interior

31

Magic-medicinal bowl

Iran, 16th–17th century

Copper alloy, cast and turned
height 5.4 cm
maximum diameter 18.7 cm
accession no. MTW 191

This shallow bowl has a short circular foot, an everted rim and a low central boss. It is undated and bears no patron's name, but on the basis of its design and execution it appears to be a Safavid product of the late 16th or 17th century.

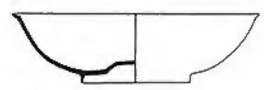
The hemispherical boss is engraved with the names of Muhammad and 'Ali, each given four times, on a hatched ground. The name 'Ali is written so as to form a four-petalled floral design in the centre. Identical bosses are found on two other Safavid magic-medicinal bowls, one attributed to the mid-16th century,[1] although there are otherwise several differences in text and design between these bowls and cat.31. The boss is encircled by a narrow chain or interlace design enclosed by a broader band of stylized lotus blossoms. The curved interior walls are covered with prayers and invocations written in Arabic, in a dense cursive script. The upper surface of the rim is engraved with invocations and affirmations of faith; the underside of the rim is blank.

On the exterior of the bowl, immediately under the rim, there is a wide band with a hatched ground bearing the 'Throne Verse' (II, verse 255) engraved in *thulth* script. Beneath this band, six roundels containing prayers and invocations in a densely written cursive script are evenly spaced around the sides of the bowl. The spaces between them are filled by three concentric bands, the middle one containing stylized intertwining vines. The texts in the upper and lower bands are to be read from top to bottom in each section between the roundels. One section of the text calls for blessing on Muhammad, gives the *shahadah*, and ends with a line from the surah *al-Baqarah* (II, verse 284). Proceeding anti-clockwise, the other sections contain Qur'anic texts from the surahs *al-Fātiḥah*; *al-Ikhlāṣ* (CXII) in the upper panel and *al-Nās* (CXIV, verses 1–3) in the lower panel; *al-Falaq* (CXIII, verses 1–5); *al-Naṣr* (CXIX, verses 1–2) in the upper panel and *al-Kāfirūn* (CIX, verses 1–3) in the lower panel; *al-Kawthar* (CVIII, verses 1–3) in the upper panel and *al-Qalam* (LXVIII, verses 51–2) in the lower panel. A narrow chain or interlace design surrounds the foot, which is undecorated.

On the underside of the bowl the Persian expression *mustajāb bād*, ('may [the prayers] be heard') is engraved three times, with a palm-leaf design positioned between the repetitions.

There are two small plug repairs in the wall of the bowl, one in copper and the other in a white metal which may be silver. In two other places, there are minute pin-sized holes where the walls of the metal dish have been thinned by extensive engraving. Presumably, the two plugs were inserted to repair similar pin-holes and thereby extend the useful life of the object.

1. Victoria & Albert Museum, London, inv. no.780–1889, attributed to western Iran in the mid-16th century (Melikian-Chirvani 1982, pp.290–92, no.125); British Museum, London, Department of Oriental Antiquities, inv. no. 1902.8–12.1 (unpublished).



31

32

Magic-medicinal bowl

Iran, early 17th century

High-tin bronze, cast and turned
height 17.3 cm
maximum diameter 45.2 cm
accession no. MTW 1444

This unusually large and elegantly engraved bowl is cast in an alloy with a rich dark-brown patina. The appearance of this alloy inside the footring gives an idea of the irregular texture of the cast metal and the need for lathe-turning after casting in order to achieve a perfectly smooth surface. The level of craftsmanhip achieved in this bowl is of an exceptionally high order. The engraving, mostly on the interior surface, has been filled with a white substance.

The bowl is hemispherical, with a slightly everted rim, and rests on a gently flaring circular foot. The exterior surface is simply ornamented with two small torus mouldings, one just below the rim, and a small number of engraved concentric lines, probably cut when the bowl was turned on a lathe. A disk plug 5.5 centimetres in diameter has been hammered in to the bottom of the bowl as part of the process of manufacture.

The circular design at the centre of the bowl is formed from eight wedge-shaped segments with scalloped ends. Four cartouches with scalloped sides and ogival arches are attached at intervals of 90 degrees to this circular design and the whole figure is filled with invocations and prayers in Arabic and Persian.

Above the tip of each of the cartouches there is a roundel with a pendant cartouche of the same form. Three of the four roundels contain prayers, the *shahadah*, and invocations, while the fourth contains Persian and Arabic titles and formulas typical of Sufi dervish orders (*tarīqah*). Reading anticlockwise, the four attached cartouches contain the surahs *al-Falaq* (CXIII), *al-Nās* (CXIV) and *al-Kāfirūn* (CIX) and more formulas and titles indicating a Sufi context. The particular Sufi order to which they relate has not been identified.[1]

The central design, the roundels and cartouches divide the interior surface of the bowl into quadrants, each containing two squares with cloud-collar profiles, five magic squares and four small circles. The circles contain prayers and invocations, including repetitions of 'O Healer, O Guardian, O Eternal One!' (*yā shāfī, yā ḥāfiẓ, yā bāqī*) and prayers for protection from 'every devil' (*min kull shayṭān*). Most of the cloud-collar squares contain prayers, sometimes employing the 'crowning words' or mystical letters with which several surahs commence.[2] Of the two such devices on either side of the roundel containing the surah *al-Nās* (CXIV), one is inscribed with the 'Throne Verse' and two following verses from the surah *al-Baqarah* (II, verses 255–7) while the other contains verses 1–5 from the same surah and the surah *al-Ikhlāṣ* (CXII). The bottom of the 'cloud-collar' square to the right of the cartouche containing the surah *al-Falaq* (CXIII) is inscribed with surah *al-Raḥmān* (LV, verses 33–4), following some prayers. Under the rim of the bowl, 21 scalloped rectangular cartouches each contain four lines of prayers and invocations.

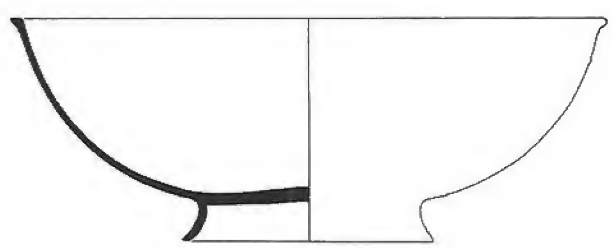
Of the 20 magic squares inscribed on the bowl, two are talismanic squares, one with four lines of magical letters and numerals, and the other with three lines and four columns of letters, mostly composed of *kāf*, *wāw*, *dāl*, and *tā'* repeated in various combinations. The remaining 18 are true magic squares; 13 are 3 × 3 squares and the remaining five are of the 4 × 4 order.

Nearly all these magic squares are correct as written, though small errors do occur in some. Of the 3 × 3 squares, all are 'augmented' squares – that is, a square with a sequence of numbers higher than the usual 1 to 9.[3] Four of the 3 × 3 squares use a sequence of nine consecutive numbers, but nine omit one digit in this sequence and hence the diagonals will not produce the same common sum as the columns and rows.

Of the five 4 × 4 squares, four are augmented, having sequences of numbers higher than 1 to 16. One of these maintains a sequence of 16 consecutive numbers, while the other three omit one digit in the sequence. With 4 × 4 magic squares, however, a break in the sequence does not affect the property of the diagonals to produce the same sum as the columns and rows. The fifth 4 × 4 square on this bowl is unusual in that it is only partially augmented, for it is formed of the numerals one to eight and 1233 to 1240, yielding a common sum of 2482. Furthermore, the pattern of placement of the numerals within the square is different from the method employed in the other 4 × 4 squares.

In all the magic squares, the numeral zero is written as a small circle rather than the more common dot, while the numeral 5 is usually represented by a figure closely resembling the modern European 3, but rotated so that it opens toward the right with the bottom curve slightly fuller. Occasionally, the bottom curve is closed so that the numeral resembles a small Greek letter *delta*. A similar form for the numeral 5 can be seen in some 17th- and 18th-century manuscript copies of treatises discussing numeral forms in use among Western Arabs.[4]

1. Following such Sufi expressions as *al-ghawth wa-al-quṭb al-a'ẓam* ('the Supreme Defender and Support') there occurs the 'title' *abū'l-barakāt ṣadr al-dīn abū'l-fatḥ imām al-matqīn sulṭān al-'āshiqīn*, perhaps implying an association with the class of mystical poet-minstrels called *'āshiq*, whose adherents were particularly numerous in various dervish orders in the 17th century (see Lewis 1960).
2. For the magic use of these letters, see the essay on talismanic charts and shirts, p.107, note 12.
3. For 'augmented' squares, see Cammann 1969, p.204, n.52.
4. For example, a copy of a treatise on arithmetic begun in 1620 and finished in 1630, and another treatise on arithmetic copied in the 18th century: Bibliothèque Nationale, Paris, MSS Arabe 2475 and 2463 (Ifrah 1981, p.503). The forms of many of the other numerals in these manuscripts differ, however, from those on the bowl.
See also Irani 1955.



33

Magic-medicinal bowl

Iran, dated AH 1050 (AD 1640–41)

Brass alloy, cast and turned
height 8.5 cm
maximum diameter 22.8 cm
accession no. MTW 190

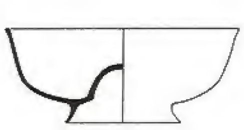
This hemispherical bowl rests on a slightly flaring circular foot. It is made of a brassy alloy, with black infilled engraving.

At the centre a large hemispherical boss is engraved with the *shahadah* in outline script. A ring of inscriptions around the boss contains invocations to God, Muhammad, the four orthodox Caliphs and Hasan and Husayn, followed by quotations from the surahs *al-Ṣaff* (LXI, verse 13, lines 2–3) and *Yūsuf* (XII, part of verse 64, lines 3–4). This ring is framed by five concentric fillets.

The curved sides of the bowl's interior are divided into 12 contiguous arched panels. The area above the arches and nine and a half of the twelve panels contain prayers written in Arabic and Persian. The surah *al-Nās* (CXIV) begins in the middle of the tenth panel and continues in the eleventh panel, where it is followed by the surah *al-Kāfirūn* (CIX, verses 1–6). The final panel contains the surah *al-Falaq* (CXIII), followed by the Shi'i metrical prayer beginning 'Call upon 'Ali, through whom miracles are made manifest' and ending with 'O God, most merciful of those who show mercy. In the year AH 1050 [AD 1640–41]'.

On the exterior of the bowl, immediately beneath the rim, a band is inscribed with various Sufi titles and epithets, and the name of Sultan Muhiyy al-Din Abu Muhammad Khawajah 'Abd al-Qadir al-Hasani al-Husayni al-Jilani, usually known simply as 'Abd al-Qadir al-Jilani (d. 1166), the mystic and founder of the Qadiriyyah order of Sufi dervishes.[1] Beneath this band of inscriptions there is a row of twelve circular medallions with scalloped rims. The medallions and the ground between them contain prayers in Arabic and Persian. Beneath this band a decorative ring formed of interlocking arches terminates at the top of the flaring foot.

1. See Braune 1960; Margoliouth 1978; and Halm 1991, p.9.



34

Magic-medicinal bowl

Iran or India

Perhaps high-tin bronze,
cast and turned
height 9 cm
maximum diameter 26.9 cm
signed 'Ali Rida
accession no. MTW 691

This deep bowl, with a rounded, conical boss and a low, slightly flaring foot, is undated, but the name of the maker is given on the underside, within the footring, as 'Ali Rida *sar-kār*. The last word is sometimes used as a title for an overseer or superintendent, and in this case may indicate that 'Ali Rida was the foreman of a metal workshop. The word may, however, be used more generally as a term of respect, like the title 'esquire'. The maker is not known from any other object. Near the maker's signature, and inscribed in the same hand, is the Persian phrase *dām iqbālhu* ('May his good fortune endure.')

In another inscription within the footring the price of 250 rupees is engraved in a different, possibly later, hand. This type of valuation is usually found on items which have been entered in royal treasury inventories. As rupees are unknown in Iran, the bowl was obviously in India at some stage in its history.

Finally, another inscription on the underside of the bowl gives the Persian phrase *haft-jūsh*, again in the same hand as the maker's signature. This is a term for high-tin bronze, forged and quenched, which usually has a very silvery appearance. The alloy of this particular piece, however, has a reddish rather than a silvery cast, nor does it exhibit the cracks that are often found in such a brittle alloy. It is possible that the word was inscribed here for the sake of its magical powers, since *haft-jūsh* was associated with magic objects and mirrors, rather than as a description of the alloy employed by the metalworker. No metallurgical tests have been made to determine the bowl's precise elemental composition.[1]

The bowl is engraved with a rather unusual design not reflected in other recorded examples. Where the interior walls flatten out near the base, six semicircles with scalloped frames contain the words *yā Allāh* ('O God!') written in large *thulth* script on a hatched ground. Below the semicircles there is a border of five fillets and above them, the *shahadah* is written in an even larger, broad *thulth*. Written behind and around this inscription, in a small *nasta'līq* script, is the entire text of the surah *Yā-sīn* (XXXVI), followed by verses 1–6 from the surah *al-Fatḥ* (XLVIII).

The top of the boss is engraved with two small concentric circles, and seven rings of cursive writing on its sides contain part of the surah *al-Fatḥ* (XLVIII, verses 6–10), reading from the top downwards. Two narrow, concentric rings and a cable surround the base of the boss and around it, on the flat bottom of the bowl, three concentric lines of writing contain verses 11–14 from the surah *al-Fatḥ*, beginning near the boss and reading outwards.

The narrow everted rim is blank. On the exterior of the bowl, immediately under the rim, there is a band of 12 elongated cartouches with hatched grounds. Written in these cartouches, in medium-sized *nasta'līq* script, is the prayer to God asking blessings on Muhammad, Fatimah, and the twelve Imams. A cable, framed by narrow concentric lines, separates this Shi'i prayer from the remaining area, which is decorated with 14 ovoid panels with ogival arches, which are all pointed at the bottom and have a small circle underneath. Prayers are engraved in a small cursive script within the spandrels between the ogival arches of the panels.

1. See p.77, above. For a history of terms for this alloy, see Allan 1979, pp.48 and 51; see also Craddock, La Niece & Hook 1990, p.98, tables 3–4, for the composition of six *haft-jūsh* vessels (none specifically magical) and three mirrors of high-tin bronze; and Craddock 1979, p.74.

33

34

35

Magic-medicinal bowl

India, possibly for the Indonesian market, dated Ramadan AH 1014 (10 January–8 February 1606)

Agate, engraved and polished
height 2.7 cm
maximum diameter 7.8 cm
accession no. TLS 6

This elegantly engraved bowl is hemispherical with a small, flat base, which is occupied by an octagonal cartouche containing an inscription. According to this, the bowl was finished in the month of Ramadan 1014 (10 January–8 February 1606), 'purposely on a Friday'. Symmetrically positioned around this cartouche on the exterior are four octagonal medallions with inscriptions in a broad script on a ground of circles and flowerheads. The four inscriptions are apparently to be read not in an anticlockwise sequence but rather one followed by the one opposite. In this order they read 'God, Muhammad, 'Ali, / Fatimah, Hasan, Husayn; / God's Will (be done!), There is no power but / with God! [XVIII, verse 39]; I ask God's forgiveness'. At the lowest point of the octagons four tiny cartouches each contain one of the names of God.

The centre of the bowl's interior is decorated with an octagonal medallion containing, in a broad *thulth* script, the *shahadah*. Five concentric rings occupy the interior walls around this central inscription. The inner ring contains the surah *al-Ikhlāṣ* (CXII), in densely written *riqā'* script. The next ring contains a large engraved flowerhead, marking the beginning of a quotation from the surah *al-Anbiyā'* (XXI, verses 87), written in a very broad script on a decorated ground. The third ring contains the surah *al-Nās* (CXIV), written in small *riqā'*. The fourth ring contains four elongated cartouches alternating with four smaller scalloped ones. The inscriptions inside these cartouches read as follows (beginning with the small medallion in line with the lower part of the central octagon): 'O Healer of diseases'; 'help from God and a speedy victory', from the surah *al-Ṣaff* (LXI, part of verse 13); 'O Exhalter of ranks'; 'And God has power over all things', from the surah *Āl 'Imrān* (III, part of verse 29); 'O Granter of wishes'; 'Which none shall touch but those who are clean', from the surah *al-Wāqi'ah* (LVI, verse 79); 'O Sufficient in difficulties'; 'And if anyone puts his trust in God [sufficient is God for him]', from the surah *al-Ṭalāq* (LXV, part of verse 3). The fifth ring, near the rim, has the 'Throne Verse' (II, verse 255) written in a small script.

This is the only recorded example of an agate talismanic bowl. Numerous cornelian, chalcedony and quartz talismanic pendants and gem stones from Safavid Iran and Mughal India are preserved in various collections, including the Khalili Collection (see cat.85 discussed below). Few of these are dated, however, and those that are come from the second half of the 17th century or later.[1] The early date on this talismanic bowl appears to provide clear evidence of the established production in India of this style of talismanic carving in agate and related stones in the late 16th and early 17th century.

1. See Kalus 1986, p.49, where two examples are dated AH 1078 (AD 1667–8) and AH 1121 (AD 1709–10); see also James 1981, p.22, for one dated AH 1072 (AD 1661).

35, exterior

35, interior

36–38

Three magic bowls

North-western India,
18th–19th century

Tinned copper alloy, cast and engraved; crack in the rim on one side
height 3.9 cm *diameter* 17.8 cm
accession no. MTW 267

Copper alloy, cast and engraved
height 6 cm *diameter* 16.4 cm
accession no. MTW 265

Copper alloy, cast and engraved
height 6 cm *diameter* 16.4 cm
accession no. MTW 217

The method of manufacture of these bowls was markedly different from that of other metal magic-medicinal bowls, in that the inscriptions were part of the casting. The pieces were turned on a lathe after casting and some of the inscriptions and decorations were touched up by engraving before the ground was filled with a dense black compound, making the large inscriptions very prominent. Although these bowls bear no magic sigla, they appear to be similar to two bowls said to have been made in Bedar and used for colic and in confinements.[1]

There is a silvery cast to the alloy of cat.36 that appears to be the result of surface treatment; it was probably tinned or silvered to conceal the rough appearance of the object after casting. At the centre of the interior, a circular medallion contains the invocations 'O Imam Hasan!, O Imam Husayn!'[2] Four concentric rings, beginning at the innermost, contain the 'Throne Verse' followed by the surah *al-Ikhlāṣ* (CXII). The inscriptions are cast with a recessed ground and are fully vocalized.

The exterior of the bowl has no inscriptions, but is decorated near the rim with a band of undulating vines enclosing flowers, a thin S-link chain, and a row of imbricated semicircles, some containing flower buds and with pendant buds at the ends.

The inscriptions on the interior of cat.37 are in a well-formed *naskh* script and are fully vowelled. The inscription on the exterior is in a casual *nasta'līq* that could have been added later.

The surface of the bowl has been badly etched with a caustic substance. Traces of a black material still adhere to the dark, recessed and hatched ground of the inscriptions. In its original condition the interior of the bowl must have been quite black, with the inscriptions in high contrast. There are three small copper repairs, one filling a hole near the rim.

At the centre of the bowl there is a roundel containing the words 'O God, lend us support!' This is surrounded by four concentric rings of inscriptions which read as follows, from the uppermost ring downwards: 'I seek refuge with God from the accursed devil'; followed by the 'Throne Verse' (II, verse 255), which extends from the upper ring into the third ring; followed by the prayer, 'O God! Bless Muhammad the Chosen'; concluding, in the inner most ring, with the prayer 'and bless 'Ali the Accepted, and bless Imam Hasan [and] Husayn the martyr of Kerbala'.[3]

The exterior of the bowl is decorated near the rim with a narrow band of small, elongated panels, beneath which is a foliate design with pendant flower buds interspersed with five larger pendants of flower buds. Between the tips of these buds is an inscription seeking God's blessing on Muhammad and 'Ali and all the prophets, ending with invocations to 'the Most Merciful of those dispensing mercy', to Muhammad, and to the first four Caliphs, Abu Bakr, 'Umar, 'Uthman and 'Ali. Another band of angular panels is placed next to the bowl's circular foot.

The interior of cat.38 also has inscriptions engraved on a recessed and hatched ground, which was once filled entirely with a black compound. A band near the rim carries a quotation from the surah *al-Kāfirūn* (CIX, verses 1–4). Verses 5–6 then continue in three of the six roundels that form a ring in the centre of the bowl. The remaining three roundels contain the *basmalah* followed by text from the surah *al-Ṣaff* (LXI, part of verse 13), which is continued in a central roundel.

The exterior, which has no inscriptions, is decorated with two series of small pointed arches, one under the rim, the other next to the foot, with an intervening broad band of four pendant designs, in a pattern similar to that on cat.37. These engraved lines, too, were once filled with a black compound. Traces are still visible in some areas, especially in the contours of the pointed arches.

Although there is no mention of 'Ali or other indication of its being intended for a Shi'i user, the bowl appears to have been made in the same workshop that produced cat.37, which was intended for the Shi'i community.

1. Ismail 1921.
2. The word *imām* has been written incorrectly as *ayymām* in both instances.
3. The name of Husayn and the word for martyr (*shahīd*) have been conflated by the engraver.

36

37

38

37

36

38

Magic-medicinal bowls in China

The great majority of magic-medicinal bowls produced in the Muslim world were made out of metal, and it is notable how few ceramic examples are known. However, porcelain magic-medicinal bowls, inscribed in Arabic, were produced in China for export to Muslim communities principally, it would seem, in South-east Asia and India. Two main groups can be identified, one whose manufacture began in the late 16th or early 17th century, the other in the late 18th. In the case of the latter group their magic-medicinal character is borne out by the frequent occurrence of magic squares. The squares are accompanied by mostly Qur'anic inscriptions, and the same choice of inscriptions occurs on technically and decoratively related items that otherwise lack the magic squares. The 16th- and 17th-century group do not bear magic squares, but the inscriptions used and their compositional layout confirm their traditional identification as magic-medicinal bowls. These two groups should, therefore, be distinguished from other Chinese porcelains inscribed in Arabic, outstanding specimens of which range from blue-and-white wares of the Xuande and Zhengde reigns[1] to a large gilded service produced evidently for the Ottoman court in the late 18th century.[2]

Group One, Swatow wares

The distinctive type of Chinese – Islamic magic-medicinal bowl produced in the late 16th to early 17th century is made of a porcellanous stoneware that is commonly referred to as 'Swatow' ware. The name Swatow arises from the early transliteration of the name of the port of Shantou, in northern Guangdong province. Shantou was not, however, the site of manufacture for these wares; in fact, no site that is known to have manufactured Swatow wares has been located.[3] The shallow, saucer-like dishes have a coarse greyish or buff-white body with a dull white, or sometimes slightly coloured, glaze, and they are usually painted in a rather unsophisticated manner. All Swatow wares, whatever their design, were apparently intended for export to South-east Asia, India or the Middle East.

The Swatow magic-medicinal bowls can be divided into three groups. The first two carry a Persian inscription that mentions 'Khan-i Khanan, follower of Akbar Shah'. Both have a central inscription within a disc surrounded by eight roundels, also containing inscriptions, and another inscription near the rim.

The nature and arrangement of these inscriptions varies. In the first group, the inscription near the rim contains a text from the surah *al-Ikhlāṣ* (CXII, verses 1–4), followed by the phrase, 'Praise be to God, my Great Lord'. The roundels contain four phrases, 'There is no god but God, Muhammad is the messenger of God' (the *shahādah*), 'I ask God's forgiveness', 'Health to the Shah' (*salāmat-i shāh*), and 'O Conqueror' (*yā fattāḥ*), each repeated twice. The names of the first four Caliphs and invocations to Muhammad and 'Ali are set between the roundels. The central disc contains the statement, 'the humble servant, well-wisher, Khan-i Khanan, follower of Akbar Shah' (*Bandah-i kamtarīn dawlat-khwāh khān-i khānah* [error for *khānān*] *marīd-i Akbar Shāh*).[4]

The second group is more overtly Shi'te. The statement naming Khan-i Khanan is given twice in two of the eight small roundels, while the other six roundels contain the statements 'There is no god but God, Muhammad is the messenger of God' and 'Glory be to God and praise to Him', each written twice, and text from the surahs *al-Ikhlāṣ* (CXII, verses 1–4) and *al-Nās* (CXIV, verses 1–6). The word *Allāh* is written between each roundel and the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255) begins near the rim and is completed in the central disc. Surrounding this disc is the metrical Shi'i poem beginning, 'Call upon 'Ali, through whom miracles are made manifest'.[5]

The reference appears to be to the Mughal Emperor Akbar I (*reg.* 1556–1605). In Akbar's day the term *Khān-i Khānān* or 'Khan of Khans' was a senior military title granted to only one person at a time.[6] The two most likely figures to whom the inscription might refer are Mun'im Khan, who was appointed *Khān-i Khānān* in 1560 and held the post until his death 15 years later, and Mirza 'Abd al-Rahim, who was given the title in 1584 and retained it until his death in 1627.[7] How the title *Khān-i Khanān* came to appear on this group of Swatow wares is unknown; either it was added to give the porcelains a spurious air of authority and efficacy, or the Swatow porcelains were derivatives of a magic bowl that was indeed produced for a member of Akbar's court, though it need not be assumed that the model was necessarily itself of Swatow ware. The third type of magic-medicinal Swatow-ware bowls are non-sectarian, and may have been produced for a quite different market than the previous types. An example in the Topkapı Palace Museum, Istanbul, has the 'Throne Verse' written in a central roundel, encircled by four smaller roundels containing undeciphered inscriptions and a poem written beneath the rim.[8] The vocalized Arabic inscriptions are written in turquoise and black enamels. A second example, cat.39, has the best calligraphy of any recorded specimen of 'Swatow' wares intended for Islamic communities, whatever the design. Although it lacks the 'Throne Verse', which generally plays such a prominent role in the inscriptions on magic-medicinal bowls, it does have verses from seven other surahs of the Qur'an inscribed in the central and six surrounding roundels. Neither of these non-sectarian 'Swatow' magic-medicinal bowls is dated, but both are attributable to the late 16th or early 17th century. The community to which they were to be exported is unknown.

Group Two, fine porcelain bowls of the 18th century

A much later type of Chinese–Islamic magic-medicinal bowl, dating from the last quarter of the 18th century and made of much better porcelain than the Swatow wares, must have been produced in sizeable quantities, for many examples are recorded. The commonest forms are either deep bowls or shallow, saucer-shaped dishes, both types decorated with concentric rings of inscriptions, most often enclosing a central magic square. On the items with a magic square at the centre, the Arabic inscriptions are always the same and are laid out in a consistent format, although the obvious lack of knowledge of Arabic on the part of the Chinese painters resulted in numerous errors or illegibly formed letters.[9] The nature of the inscriptions indicates that the wares were intended for shipment to centres of Shi'ism. At least 25 items of this design are known, including two particularly fine examples in the Khalili Collection, cat.40 and 42.

The 4 × 4 magic square occupying the centre of the design is always the same, although numerous mistakes were made by the painters of the porcelain, who clearly did not understand Arabic numerals. Of the 16 sets of numerals in the square, on average only about five or six are correct as written on the bowls. The square that was in the original pattern employed by the workshop producing these wares can be reconstructed as follows:

48	51	54	41
53	42	47	52
43	56	49	46
50	45	44	55

The square's common sum is 194. Around the square the Shi'i formula usually rendered as 'There is no hero except 'Ali and there is no sword except Dhu'l-Faqar' is written in four parts. On all Chinese – Islamic magic bowls of this design, the word 'conqueror' (*fattāḥ*) is written instead of the word for hero (*fatan* or *fatā*).[10] The Shi'i formula is often found on amulets, on military pieces, and on printed talismanic charts with drawings of swords, Dhu'l-Faqar being the name of the famous sword that the Prophet Muhammad acquired as booty in the battle of Badr.[11]

On the saucer-shaped dishes with a central magic square there are five concentric bands of inscriptions. The four outer bands, beginning with that nearest the rim, contain the 'Throne Verse' and following verses from the surah *al-Baqarah* (II, verses 255–7) followed by a set of prayers and invocations: 'There is no god but God, Muhammad is the messenger of God. There is no god but God, great is His splendour. There is no god but God, great is His praise. There is no god but God, sacred is His name. There is no god but God, exalted is His majesty. There is no god but God, to Whom there is allegiance. There is no god but God, with Whom there is protection. There is no god but God, in Whom there is trust. In the name of God the Healer. In the name of God the Sufficient. In the name of God the Restorer. In the name of God, by Whose name nothing causes harm on earth or in heaven. He heareth and knoweth all things.' The innermost, fifth, band contains the metrical Shi'i prayer beginning, 'Call upon 'Ali, through whom miracles are made manifest.'

On the deep-sided bowls, the square is enclosed by the four-part Shi'i formula at the bottom, surrounded by a ring of Arabic containing the metrical Shi'i prayer calling upon 'Ali. On the outside of the bowl, four bands of Arabic inscriptions are interspersed with bands of decoration; the text of the Arabic here is identical to the outermost four bands on the inside of the saucer-shaped dishes.

Although the inscriptions and magic square remain constant on these porcelains, the vessels come in a variety of forms and decorative patterns. At least four examples of bowls and dishes with bracket-lobed rims have been recorded, all with concentric rings of inscriptions in black enamel separated by red enamel chain-like bands.[12] On all the other known examples, the rims are smooth. Variations occur in the decorative bands that separate the

rings of inscriptions – these sometimes take the form of small, four-petalled flowerheads or, more commonly, foliate scrolls – and in the colour of the inscriptions, which may be written in black, gold,[13] or gold on a dark blue ground.[14] Occasionally the foliate scrolls are in red enamel, with the inscriptions in gold on a dark blue ground;[15] more often they are in red enamel with the script in black enamel or in gold that has now faded.[16] At least three examples are known where the foliate scrolls were painted in gold, now badly faded, with the inscriptions in black enamel.[17] The most elaborately executed scrolls tend to be those painted in dark blue enamel, like cat.40.[18] In terms of the execution of the script and the foliate scrolls, this is one of the best recorded examples of a Chinese–Islamic magic-medicinal bowl with a magic square.

Very similar porcelain magic-medicinal bowls, but lacking the central magic square, were apparently made by the same workshops that produced the more common type. Also made for export to Shiʿi communities, this second type is less well-known, and is represented by two pieces in the Khalili Collection (cat.41 and 42) as well as by two unpublished examples in London.[19] Like those with magic squares, these vessels were produced in two shapes, a saucer-like dish and a deep-sided bowl. Instead of a magic square, this type of ware has the *shahādah* in a two-part inscription at the centre. On the shallow dishes nine concentric bands enclose the central inscription, similar to those on the bowls with magic squares, and in the bands a foliate scroll design alternates with Arabic writing. The text in these bands differs, however, from that on vessels with magic squares, for in this design the five bands of Arabic contain only the 'Throne Verse' and the two following verses from the surah *al-Baqarah* (II, verses 255–7) followed by the metrical Shiʿi prayer beginning 'Call upon ʿAli, through whom miracles are made manifest'. In the case of the deep bowls, this prayer encircles the central inscription in a single band, with the 'Throne Verse' and following verses written on the outside of the bowl in four bands that alternate with three bands of foliate scrolls with flowers placed at regular intervals.[20]

This brief survey of the extant Chinese–Islamic magic-medicinal bowls demonstrates that they were produced in two main phases – the Swatow wares in the late 16th and early 17th century, and the fine porcelain wares in the late 18th century. Despite their common function they are of quite different types and come from different centres of manufacture. This suggests that there was no continuity in the production of magic-medicinal bowls within China, and therefore no market for them in that country. They were made intermittently in response to demand from Muslim communities outside China, but they appear to have had no influence on the pottery of the areas to which they were exported.

1. For two examples with Shiʿite inscriptions in the Topkapı Palace Museum, see Krahl 1986, II, pp.579–80, nos.777 and 778; see also Donnelly 1975, fig.1. For two examples of non-sectarian character in the Topkapı Palace Museum, see Krahl 1986, II, p.580, nos 779–80. The largest Chinese–Islamic dish with a Zhengde mark (58.5 centimetres in diameter) appears to be non-sectarian. It was in the collection of the Ardabil Shrine and is now in the Iran Bastan Museum, Tehran, Ardabil Collection, inv.no. 8847; see Pope 1956, pls 75 and 76 and Tehran 1981, no.58.
2. Krahl 1986, III, pp.946 and 1291–3.
3. Krahl 1986, II, p.883.
4. Four plates of this design are now in the Muzium Negara, Kuala Lumpur, inv.nos BKP.198.1979.IS(4), BKP.200. 1979.IS(6), BKP.204.1979.IS(10) and BKP.206.1979.IS(12); see Yatim 1981, pls 5, 7, 9 and 10 for illustrations and pp.22–4 for a partial reading of the inscriptions. Another plate of this design was in the Bibi Baqbara Collection, Aurangabad; see Hunt 1916, pp.63 and 69–70, where a translation is given but no photograph or transcription. Two more are in the Museum Het Princessehof, Leeuwarden, inv.nos GRV 1929, 331 and GAM 914; see Harrison 1979, pp.110–113, nos 226–7.
5. Two examples are in the Muzium Negara, Kuala Lumpur, inv.nos BKP.199.1979.IS(5) and BKP.202. 1979.IS(8); see Yatim 1981, pls 6 and 8. Another bowl, acquired in Hyderabad, was in the private collection of E. H. Hunt; see Hunt 1916, pp.63–9 and pls XII and XXVII(a). A fourth is illustrated by Te-k'un 1972, p.205 top.
6. For this title, see Haq 1978.
7. For the former, see Ali 1993. For the latter, see Hasan 1960; and Hunt 1916, pp.62–65, for arguments that Mirza ʿAbd al-Rahim is the most likely candidate. There were those who asserted that Mirza ʿAbd al-Rahim secretly followed Shiʿi tenets, though he was professedly a Sunni.
8. Topkapı Palace Museum, Istanbul, inv. no.TKS 15/3069; see Krahl 1986, II, pp.480 (colour illustration) and 895, no.1939.
9. Occasionally the Arabic is virtually unintelligible; see the examples in the Science Museum, London, inv. no. A134286 (unpublished) and in the Muzium Negara, Kuala Lumpur, inv. no.BKP.224.1979.IS(3), illustrated in Yatim 1981, p.77, pl.19.
10. This word also occurs occasionally on artefacts other than Chinese–Islamic ceramics. For example, see Alexander 1992, p.228, cat.126, a sabre dated AH 952 (AD 1545–6) but probably made in the 19th century. The word is also sometimes written as *faṭā'* ('youth'); see Alexander 1992, p.222, cat.62; and Canaan 1937–8, p.147.
11. Mittwoch 1965; Canaan 1937–8, p.76. Muslim iconography represented the sword with two points, or bifurcated.
12. One of these bowls is in the Topkapı Palace Museum, Istanbul, inv. no.TKS 15/5510; see Krahl 1986, III, p.1342, no.3541. Two are in the Muzium Negara, Kuala Lumpur, inv. nos BKP.223.1979.IS(2) and BKP.224.1979.IS(3); Yatim 1981, pls 17 and 18. A fourth is illustrated in Te-k'un 1972, p.157.
13. For example, a dish in the Muzium Negara, Kuala Lumpur, inv.no.BKP.226.1979.IS(32).
14. Collection of E.W. Hunt, Hyderabad (Hunt 1916, pls XXVI and XXVII,b); Muzium Negara, Kuala Lumpur, inv. no.BKP.233.1979.IS(39) (Yatim 1981, pl.21); and an unpublished bowl, present whereabouts unknown.
15. Topkapı Palace Museum, Istanbul, inv. no.TKS 15/5500 (Krahl 1986, III, p.1343, no.3543), and an unpublished bowl, present whereabouts unknown.
16. Examples of those with black script are Science Museum, London, inv. nos A134286 and A661021, unpublished; British Museum, London, Department of Oriental Antiquities, inv. no.619B, unpublished; Muzium Negara, Kuala Lumpur, inv. no.BKP.224.1979.IS(30) (see Yatim 1981, pl.19); and a private collection (Te-k'un 1972, p.158). Those with gilt script are Science Museum, London, inv. no.A661025, unpublished, and Topkapı Palace Museum, Istanbul, inv. no.TKS 15/5509 (Krahl 1986, III, p.1342, no.3542).
17. British Museum, London, Department of Oriental Antiquities, inv. no.619A, unpublished; see also the catalogue of a sale at Sotheby's, London, 25 April 1990, lot no.462, where a pair are illustrated.
18. Of the three known to be of this design, two, including POT1270 (ex-catalogue), had inscriptions in gold that is now very faded, while cat.40 has the Arabic script written in gold enamel over-enamelled with red.The other known example is in the British Museum, London, Department of Oriental Antiquities, inv. no.619, unpublished.
19. British Museum, London, Department of Oriental Antiquities, inv. no 620; Science Museum, inv. no.A661020.
20. On the four known examples of this type of porcelain magic-medicinal bowl without the magic square, the script and the foliate scrolls were all painted in gold enamel and emphasized by overlaid red lines, while the flowers were painted in gold enamel and the details and outlines highlighted in red enamel. The flowers' stamens are rendered in fine lines in black enamel. These all appear to have been produce by the same workshop, probably the same one that made cat.40, where the inscriptions are painted in a similar style: it is clear that several of the workshop's artisans were employed in producing the wares, and that some took more care than others with the scroll design and when copying the Arabic inscriptions, which they evidently could not understand.


بسم الله الرحمن الرحيم
قل اعوذ برب الفلق

39

Magic-medicinal bowl

China, late 16th century
or early 17th century

Porcellanous stoneware;
firing flaw on the underside
height 8.1 cm *diameter* 40.8 cm
accession no. POT1433

This large, saucer-shaped dish, which rests on a low foot, is the finest recorded example of 'Swatow' ware made for export to the Islamic lands. The fully vocalized Arabic inscriptions have been carefully written by someone who knew the language – a most unusual feature on Chinese–Islamic magic-medicinal bowls. There are no inscriptions that would indicate that the vessel was intended for Muslims of the Shi'i sect, nor is it inscribed with the nearly ubiquitous 'Throne Verse' from the surah *al-Baqarah* (II, verse 255).

The text is composed entirely of Qur'anic verses. In the centre of the bowl are the surahs *al-Qadr* (XCVII) and *Quraysh* (CVI). A band of inscriptions with the surah *al-Falaq* (CXIII) encompasses the central disk. Six roundels, defined by a thin ring of green enamel outlined with black, contain further Qur'anic texts: reading anticlockwise from the top, the surah *al-Zilzāl* (XCIX) occupies the first four roundels, and *al-Fīl* (CV) the last two. The *shahādah* is repeated in the spaces between the roundels. The surah *al-Humazah* (CIV) is inscribed immediately beneath the rim, followed by 'God protect me from Satan, the rejected one', a variant of verse 98 from the surah *al-Naḥl* (XVI).

All the Arabic inscriptions are painted in copper-red enamel except for those in the band encircling the central disc, which are dark green over-enamelled with black. Two thin copper-red lines circumscribe the design at the rim, with additional lines enclosing the central disk and its surrounding ring of inscriptions. The outside of the bowl is decorated with three bands of cloud scrolls of Chinese design painted in red enamel.

40–42

Three magic-medicinal bowls

China, *circa* 1790–1820

Porcelain
height 4 cm *diameter* 20.2 cm
accession no. POT1271

Porcelain
height 3.9 cm *diameter* 20.4 cm
accession no. POT253B

Porcelain
height 6.7 cm *diameter* 14.2 cm
accession no. POT253A

These undated bowls were all produced during the middle of the Qing Dynasty period (1644–1911), between about 1790 and 1820. Cat.40 is an undated saucer-shaped dish, with the central 4 × 4 magic square typical of this type of ware. The content of the inscriptions on this example is consistent with other porcelain vessels with magic squares made in China for export to Shi'i communities in Iran, although the quality of the calligraphy and the delicacy of the floriate scrolls is outstanding.

The Shi'i formula, 'There is no conqueror except 'Ali and no sword except Dhu'l-Faqar' is written around the four sides of the square. Nine concentric bands outlined in black enamel contain, alternately, foliate scrolls in blue enamel and Arabic inscriptions in gold enamel over-enamelled with red. The same treatment has been given to all the inscriptions and numerals in the magic square, and the black cells of the square have also been highlighted in gold. The inscriptions in the four outermost concentric bands consist of the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255), followed by the invocations and affirmations of faith found on all Chinese–Islamic porcelain magic bowls and dishes of this type. The innermost concentric ring has the metrical Shi'i prayer beginning, 'Call upon 'Ali, through whom miracles are made manifest'. The outside of the bowl is undecorated.

Cat.41 is a saucer-shaped dish which has no magic square in the centre, but instead, a very poorly formed two-part inscription of the *shahādah*. Black enamel lines separate the nine concentric bands in which Arabic inscriptions alternate with foliate scrolls separated at intervals by small flowers. The inscriptions comprise the 'Throne Verse' and the two following verses from the surah *al-Baqarah* (II, verses 255–7), concluding in the innermost ring with the metrical prayer calling upon 'Ali.

All the writing and the foliate scroll design have been painted in gold enamel emphasized with red enamel. The delicate flowers placed at intervals in the scrolling design are in gold enamel, with fine details overpainted in red. Although the rendering of the Arabic is quite corrupt due to lack of understanding on the part of the painter, the quality of the decorative work and calligraphy is very fine. The outside is blank. A virtually identical bowl, also undated and evidently from the same workshop, is now in the British Museum.[1]

Cat.41 was apparently intended as a companion piece to cat.40, with which it shares elements of design and the manner of executing the inscriptions and decoration, in gold enamel overpainted with red enamel for emphasis.

On the inside, beneath the rim, a band of foliate scrolls separated at intervals by flowers is enclosed by two concentric black enamel lines. At the bottom of the bowl there is a very inept attempt at copying the *shahādah*, and two more black enamel lines enclosing a band containing virtually illegible attempts at copying Arabic. When compared, however, with a bowl in London, which is identical in design but with more carefully executed Arabic inscriptions,[2] it is evident that the band was intended to carry the metrical Shi'i prayer beginning, 'Call upon 'Ali, though whom miracles are made manifest.'

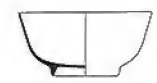
On the outside of the bowl, black enamel lines demarcate seven concentric bands containing, alternately, corrupt Arabic script and foliate scrolls with flowers placed at regular intervals. A comparison with the London bowl suggests that the inscriptions were intended to represent the 'Throne Verse' and following verses from the surah *al-Baqarah* (II, verses 255–7), which is in keeping with the text on cat.40.

While this bowl is probably a product of the same workshop, the two pieces would appear to be the work of different artisans. Although heavily repaired, the London bowl is certainly from the same workshop as cat.42, but was painted by an artisan who took more care in copying the unfamiliar Arabic script and rendering the foliate scrolls.

1. British Museum, London, Department of Oriental Antiquities, inv. no.620; unpublished.
2. Science Museum, London, inv. no.A661020; unpublished.

40

41



42

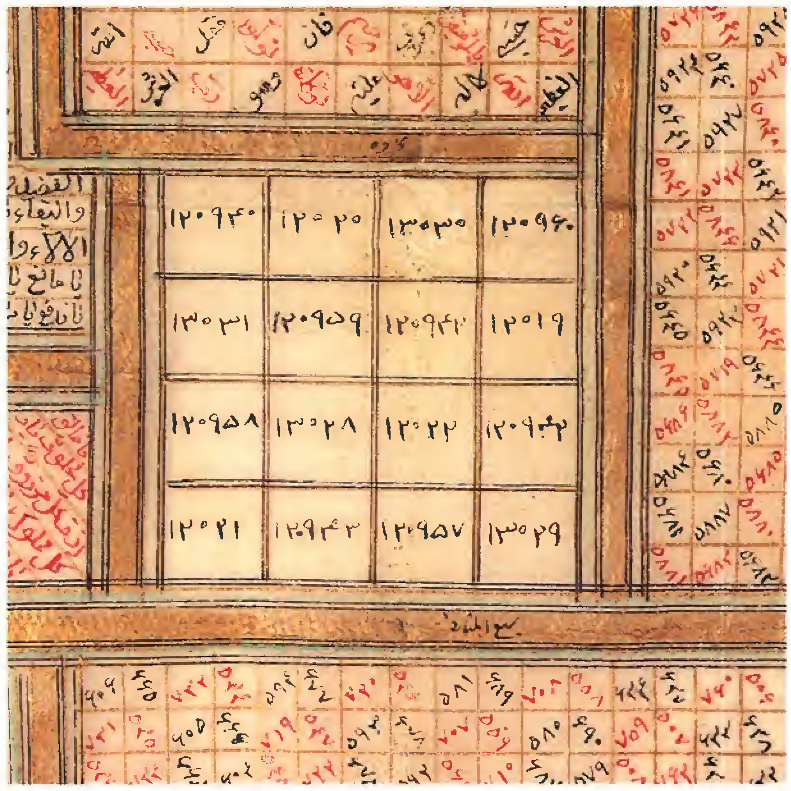
40

41, 42

The Khalili Collection includes no less than seven talismanic charts of a type that has been generally overlooked in the scholarly literature. Some were folded until they were of a convenient size to be carried about the person; others were perhaps placed on a wall to serve as a household amulet, or integrated into household objects, in one instance attached to the inside cover of a lacquered mirror case (cat. 48). All recorded examples are from the 18th and 19th centuries, and are of either Ottoman or Qajar workmanship. The examples in the Khalili Collection include one late Safavid, five Qajar, and one early 18th-century Ottoman example.

The latter, cat. 43, completed in AH 1134 (AD 1722) for a certain Mustafa ibn Ibrahim, is notable for its unusually informative text about the construction and use of the talisman. The 99 *asmāʾ al-ḥusnā* ('Beautiful Names [of God]') play a central role for, in the band near the periphery of the chart, all of them are repeated 18 times, with further repetitions surrounding the central ring.[1] It is also stated that the *asmāʾ al-ḥusnā*, the name of the Prophet and his description (*ḥilyāh*) and the 114 surahs of the Qur'an – presumably only their titles – are written according to the numerical values of the letters composing them. It has not been determined whether this is in fact the underlying pattern for the maze of numerals swirling about the broad ring surrounding the central inscription. The *ḥilyāh* (literally, 'ornament') of the Prophet consisted of short statements about the Prophet's physical and moral qualities, and its veneration was particularly widespread in Ottoman Turkey.[2] The Ottoman chart, backed by a silk lining, has clearly been folded and refolded for carrying in a container, in keeping with the instructions given on the sheet itself. These go on to assert that a person who carries the talisman at his side will be protected from numerous afflictions and misfortunes.

Four of the Qajar charts are very large in format and all show signs of having been folded so as to be portable. Three of them are undated, and on one of these it is stated that it will protect the owner from disease, plague, the evil eye, the devil and other misfortunes. The fourth chart was made in AH 1337 (AD 1919) for someone named Riza'i in order to protect him while travelling. The fifth Qajar chart is much smaller and was not intended to be carried on the person, being attached to the inside of a mirror case (cat. 48). It was made in AH 1300 (AD 1882–3). The belief that simply gazing at a talismanic design is efficacious – rather than carrying it or reading it aloud – underlies its layout.



44, detail showing magic square

The design at its centre is the 'Seal of Prophethood' (in Persian, *muhr-i nubuvvat*; in Arabic, *khātam al-nubuwwah*) which, it is said, will provide protection from sudden death if it is looked at after each of the daily prayers. The Seal refers to a special mark borne by Muhammad which is unanimously described by all the sources as a type of mole or fleshy protuberance located between the Prophet's shoulder blades. It was by this mark, according to one source, that the Christian monk Bahira' in Syria recognized him as the last prophet.[3] According to another account, a physician named Ibn Abi Ramthah al-Tamimi is said to have noticed the growth between his shoulders and offered to remove it, but the Prophet refused.[4] In the famous account of his 17th-century travels, Evliya Çelebi described a group of seal engravers in Istanbul, comprising 40 workmen in 15 shops, who specialized in silver seals and talismans. Their *pir*, or patron saint, was 'Ukkashah who, upon seeing the mark on the Prophet's back, made talismanic formulas inspired by it which were still being reproduced by the engravers at the time of Evliya's writing.[5]

The talisman representing the Seal of Prophethood on cat. 48 consists of five short lines of letters intended to be of magic significance. Any numerical or literal significance is not readily apparent. In contrast, an Arabic talismanic chart with the Seal of Prophet-hood, printed in Cairo, has no magical letters representing the seal,[6] but a circular cartouche simply containing an affirmation of faith, 'God is one, He has no partner, Muhammad is His messenger, indeed You are victorious.' On either side of this device is the statement that it is an example of the '*khātam al-nubuwwah* which was between his shoulders' and that it was copied from a poem. The uses of the chart are listed beneath: whoever looks at it before the morning prayer will keep safe until sunset and whoever looks at it at sunset prayer God will preserve until dawn. Similarly, whoever looks at it on the first of the month will be kept safe until its end; whoever looks at it on the first of the year, God will preserve from misfortune and affliction to its end; whoever looks at it at the start of travelling will travel with *barakah* ('blessing'); and should he die during the year, he will conclude his life with good fortune.

The concept of gaining grace and protection from looking at a talismanic design, in this case a design other than the Seal of Prophethood, is evident in two Iranian talismans published early in the 20th century. On one, a circular diagram at the centre is to be looked at daily after each of the five prayers, in order to obtain protection from evil, illness and injury. The second consists of seven talismans, one for each day of the week, each one a 5 × 5 square with five of the *asmāʾ al-ḥusnā* across the top and four rows of numerals beneath. On each day of the week the designated design is to be gazed upon after the morning prayer.[7]

The notion of there being a talismanic virtue in merely looking at a magic design is also the underlying principle for a composite chart produced for the Twelver Shiʿi community, possibly in the late Safavid period (cat. 106). This undated chart is found on the first folio of a carefully executed large-format volume. In addition to bearing the names of the Twelve Imams, the chart is composed of ten different talismanic designs, including squares containing Qur'anic verses whose viewing will avert misfortune, diagrams assuring that whoever looks at them will not become ill during the month, and three talismanic designs to be viewed when first seeing the new moon. This chart was apparently not intended to be carried, or even attached to wall, but was meant to remain within the slim volume in which it is bound. A somewhat similar Iranian chart of approximately the same date is now in the library of St Andrews University.[8] It is colourful and carefully executed, with rectangular cells filled with invocations for certain specified conditions, such as gall stones, smallpox and pains in the joints. In this case, the potential user is to do more than simply look at the designs, but it is clear that this chart was also once part of a bound volume, for the heading of the page reads, 'The remainder of the twenty-eighth chart on invocations for illness of the body'. In both instances, the talismanic charts were intended for periodic consultation rather than everyday use.

An extensive use of magic squares distinguishes most of the Qajar products, with three of the sheets dominated by a massive 100 × 100 magic square of 10,000 individual cells. In the magic squares on cat. 44, 46 and 47, the sum of the numerals in each of the rows and columns and in the two diagonals equals the astounding sum of 500,050. The 100 × 100 magic squares occurring on these three charts are the largest numerical magic squares yet recorded.[9]

Magic squares

Magic squares of much smaller size played an important role in Islamic talismanic designs. The first appearance of such a square (*wafq*) in Islamic literature occurs in the group of writings attributed to Jabir ibn Hayyan, known in Europe as Geber, and generally thought to have been compiled at the end of the 9th or early 10th century. The magic square recommended as a charm for easing childbirth in the Jabirean corpus is thought to be of Chinese origin. It consisted of nine cells with the numbers 1 to 9 arranged with 5 in the centre so that the contents of each row, column and the two diagonals added up to 15. The numbers were written in the *abjad*

system of Arabic letter-numerals, and because the four corners of the square contained the letters *bā'*, *dāl*, *wāw* and *ḥā'* the square became known as the *budūḥ* square. So popular was this magic square that the name itself was assigned talismanic properties.[10] In subsequent years Islamic writers developed a variety of methods for forming magic squares of higher order, with 4 × 4, 6 × 6 and 7 × 7 squares being particularly popular. By the 13th century the art was highly developed, and numerous designs can be found in manuals such as those by the 13th-century authority on magic, al-Buni, although the largest magic square that he produced was only 10 × 10.[11]

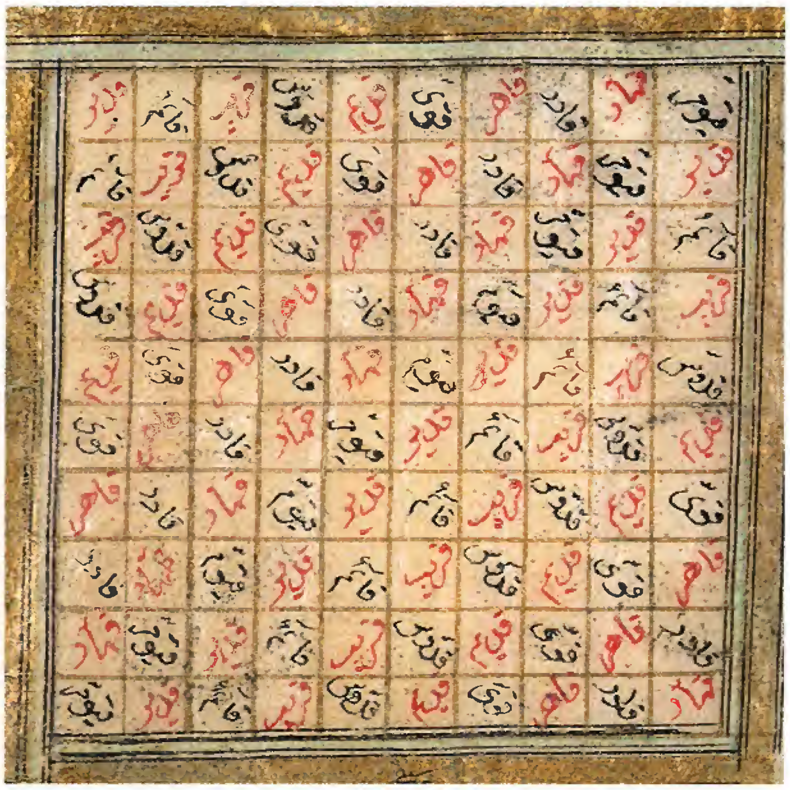
Some felt that the centre cell in a magic square of uneven order, such as 3 × 3, 5 × 5 or 7 × 7, was particularly symbolic, representing God at the centre of the universe. Consequently this centre cell was occasionally left blank or filled with names of God. There are two 5 × 5 numerical squares with the centre cell filled with invocations to God on cat. 44.

Latin squares

Two of the Qajar paper charts (cat. 44 and 47) have, in addition to the magic squares, designs known as Latin squares (in Arabic, *wafq majāzī*). A Latin square is one in which each row and each column contain the same set of symbols, be they numerals, letters, words or abstract marks. In order to avoid repetitions, no two rows or columns have the symbols in the same order. The four letters forming the word *Allāh* might be used, for example, to form a 4 × 4 Latin square, in which each row and each column contains just those four letters. Squares formed from the letters in the 'crowning words' or mystical letters that begin some of the Qur'anic surahs appear on both of the Qajar sheets,[12] while on cat. 44 there are also Latin squares using some of the *asmā' al-ḥusnā*, one name per cell. Because this type of square often uses Qur'anic phrases or the names of God, they were considered of great protective value.

The 'verse square'

A third type of square occurs on the composite chart, cat. 106, and on the Safavid talismanic shirt, cat. 49, described below, both of which appear to have been made for members of the Twelver Shi'i community. This type of magical square we might term a 'verse square'. The cells of such squares are filled with words but are not arranged as they would be in a Latin square. Rather, in each consecutive row one word is dropped on the right side and a new one added on the left side, so that an entire verse from the Qur'an is

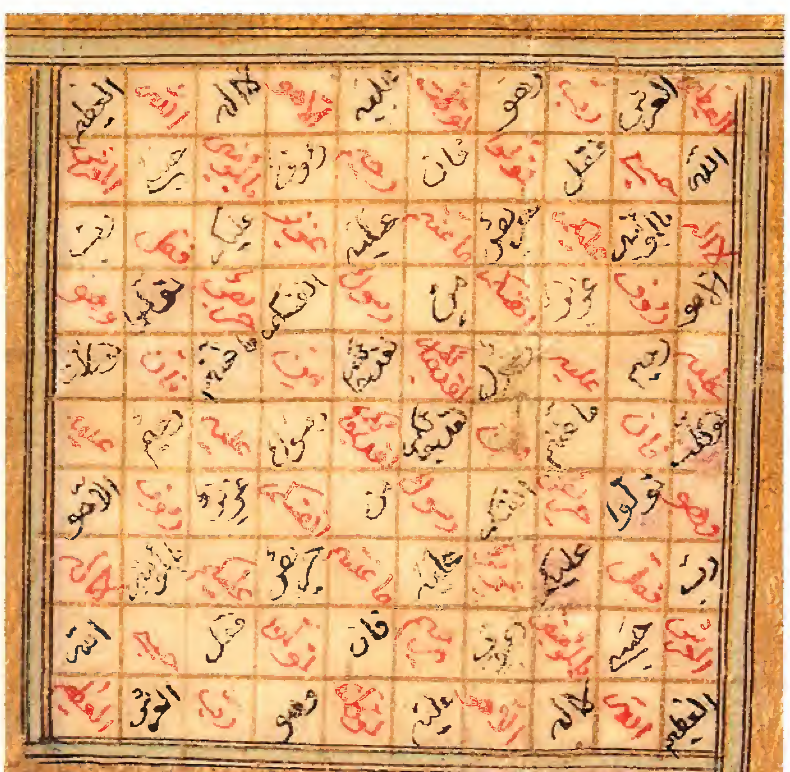


44, detail showing Latin square

worked into the square, and can be read in its entirety by reading across the top row and down the left-hand column of the square. The size of such a square is determined by the length of the verse selected.

One of the large Qajar talismanic charts, cat. 45, has no magic square, but is nonetheless closely related to cat. 44 in design. The smaller sheet in the lacquered mirror case also lacks such squares. All of the talismanic charts, both Ottoman and Qajar, have the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255) inscribed upon them, sometimes several times.[13]

1. For the *asmā' al-ḥusnā*, or epithets of God, see Gardet 1960; Doutté 1908, pp. 199–203; Fahd 1966, pp. 234–41; and Gimaret 1988.
2. Schimmel 1985, pp. 36–9 and Safwat 1996, pp. 46–50.
3. Schimmel 1985, p. 34. The *khātam al-nubuwwah* is to be distinguished from the Prophet's seal or signet-ring (*khātam*), which tradition says he had made in order to write to the Byzantines, who, he had been informed, would only read a letter if it had a seal; see Allan & Sourdel 1978, p. 1103.
4. Ibn Abi Usaybi'ah, I, p. 116.
5. Deny & Nizami 1993, p. 172. See Schimmel 1985, pp. 91–2, for an early tradition relating a talisman in the form of 16 of the *asmā' al-ḥusnā* to the Seal of Prophethood and recommending its placement in a shroud to ensure freedom from pain in the grave and the forgiveness of sins.
6. The undated, unsigned talisman, 20.7 × 13.5 centimetres, was acquired in Assuan in 1987 and appeared to have been recently printed. It is reproduced in a small facsimile by Fodor (1990, p. 102, no. 189).
7. Shirazi 1908; and Phillott & Shirazi 1906.
8. University of St Andrews, University Library, Islamic MS. 22a (MS. PJ7741.F6), 25 × 40.3 centimetres; it is reproduced in colour in Savage-Smith 1993, p. 165.
9. A 30 × 30 square was previously stated to be one of the largest ever produced; see Cammann 1969, p. 207.
10. See Macdonald 1981 and Graefe, Macdonald & Plessner 1965. For further history of magic squares in Islam, see Cammann 1969; Schuster 1972; and Sesiano 1980–87.
11. For al-Buni, see the discussion of cat. 2 and 22. The anonymous treatise on the subject based on another authority, al-Bistami (d. 1454), also has no magic squares larger than 10 × 10; see cat. 21. For a 12 × 12 magic square by al-Zinjani (*circa* 1250), see Sesiano 1980–87 (1981), part 2, p. 259.
12. For the magical use of these letters, see Canaan 1937–8, pp. 94–5; Bell & Watt 1970/1977, pp. 61–5; and Bellamy 1973.
13. For the incidence of this verse on items in the Khalili Collection, see Table 1.



44, detail showing 'verse square'

43

Talismanic chart

Turkey, dated Rabi' I 1124
(April–May 1712)

Paper over a loose, dark green, silk backing, 46.2 × 34.3 cm, written in *naskh* and *thulth* scripts
scribe al-Hajj Musa
accession no. MSS 759
published Geneva 1995, no.181; Safwat 1996, no.47

This large talismanic chart has been folded many times to form a small rectangle with dimensions of 8.5 × 5.9 centimetres, so that it might be carried on the person, probaby in an amulet case, though this is now missing.

The central gold circle encloses an inscription in Turkish that is unusual in providing detailed information about its composition and intended use. It reads as follows: 'It was begun at the hour of the Moon, and it was completed at the hour of Venus in the year AH 1124, on a Sunday in the month of Rabi' I [April–May 1712]. There is a tradition by Ibn 'Abbas, one of the noble Companions, May God be pleased with him, that God, May He be praised and exalted, will grant 100 different wishes of anyone who copies out this *fürkan tılsımı* in the following manner and carries it [on his person]:[1] 70 of them for the next world and 30 for this. What is more, He will keep him safe and protect him from 1001 disasters and misfortunes, because of His benevolence and generosity, for all 1999 Beautiful Names[2] are included in it several times over. Furthermore, the Beautiful Names, the noble name of God's messenger, his noble description,[3] and the 114 surahs of the ancient word [the Qur'an] have been written with letter-numerals according to *jummal-i kabīr*.[4]

'But he must be diligent, and he must hold it and wear it with respect and reverence and unalloyed credence. For if this talismanic document is at someone's side, his difficult affairs will be made easy, and his bad affairs will turn to good, with God's permission – May He be exalted! Whereas, if someone does not believe, he will have bad luck, and he will be a hypocrite – We take refuge in God from that! For the angels will be the guardians of the man who carries this talismanic document upon his person; disaster, misfortune and mishap will not befall him, if God so wills, May He be exalted. So, do not give it to men who do not know its power, nor to hypocrites, and do not let them copy it, so that they do not become the victims of extreme torment. It is not something that should enter their possession: let there be no negligence. For someone who carries this talismanic document on his person will not be [one who] does not see the blessed beauty of God's messenger or his own place in paradise. He will be free of the punishment of the grave and the fire of Hell, if God so wishes it – May He be exalted!

'Moreover – God, May He be exalted – will protect the person who carries this talismanic document at his side from the evil works of *jinn*s and Satan, from the misdeeds of his enemies and oppressors, from brigands, from water, from fire, from snakes, from scorpions, and from animals that bite. In addition, He will protect him from magic, from binding spells [*ribāṭ*], from being tongue-tied, from false accusations, from weapons of war, and from fear. What is more, He will keep him safe from the malicious look, from the [wagging] tongue, from the evil eye, from a ruined reputation [*balā-i esmā'*], from plague,[5] from paralytic stroke,[6] from the simoom,[7] from the fury of the thunderbolt, from sudden death, and from all misfortunes and disasters. He will make him honoured and respected among His creatures, an object of awe and blessed by good fortune; He will bless his life and livelihood; at his last breath He will bring it to an end in true belief; and He will make him a beneficiary of the intercession of God's messenger – [all this] because of His benevolence and generosity, [concerning which] there can be no doubt or hesitation.

'What is more, if a slave carries this talismanic document, he will soon be manumitted, if a prisoner of war carries it he will be freed, and if a pregnant woman carries it, she will give birth quickly. Moreover, if a timid man carries it, he will be safe from fear, with God's permission – May He be exalted! Furthermore, God – May He be exalted! – will cause a person who carries this talismanic document on him to attain the path of righteousness, good fortune, and virtue, and [in addition] advantages in this world and the next will be forthcoming.

'No one knows the end of the explanation of this talismanic document apart from God – May He be exalted! Herein many particulars have been listed. From day to day, of course, they become better known. If a person wishes to obtain eternal good fortune and felicity, he should not allow it to leave his side while he is alive. In a short time its advantages will become apparent. [These are] among the blessings of this talismanic document, with God's permission – May He be exalted!

'If he recites one of the names of God – the name of God which is in conformity with his own name[8] – and reads it every day after the five canonical times [of prayer] for the rest of his life, God – May He be exalted! – will bless his life and livelihood and [will reward] him with good fortune in both worlds, if He wills – May He be exalted!'[9]

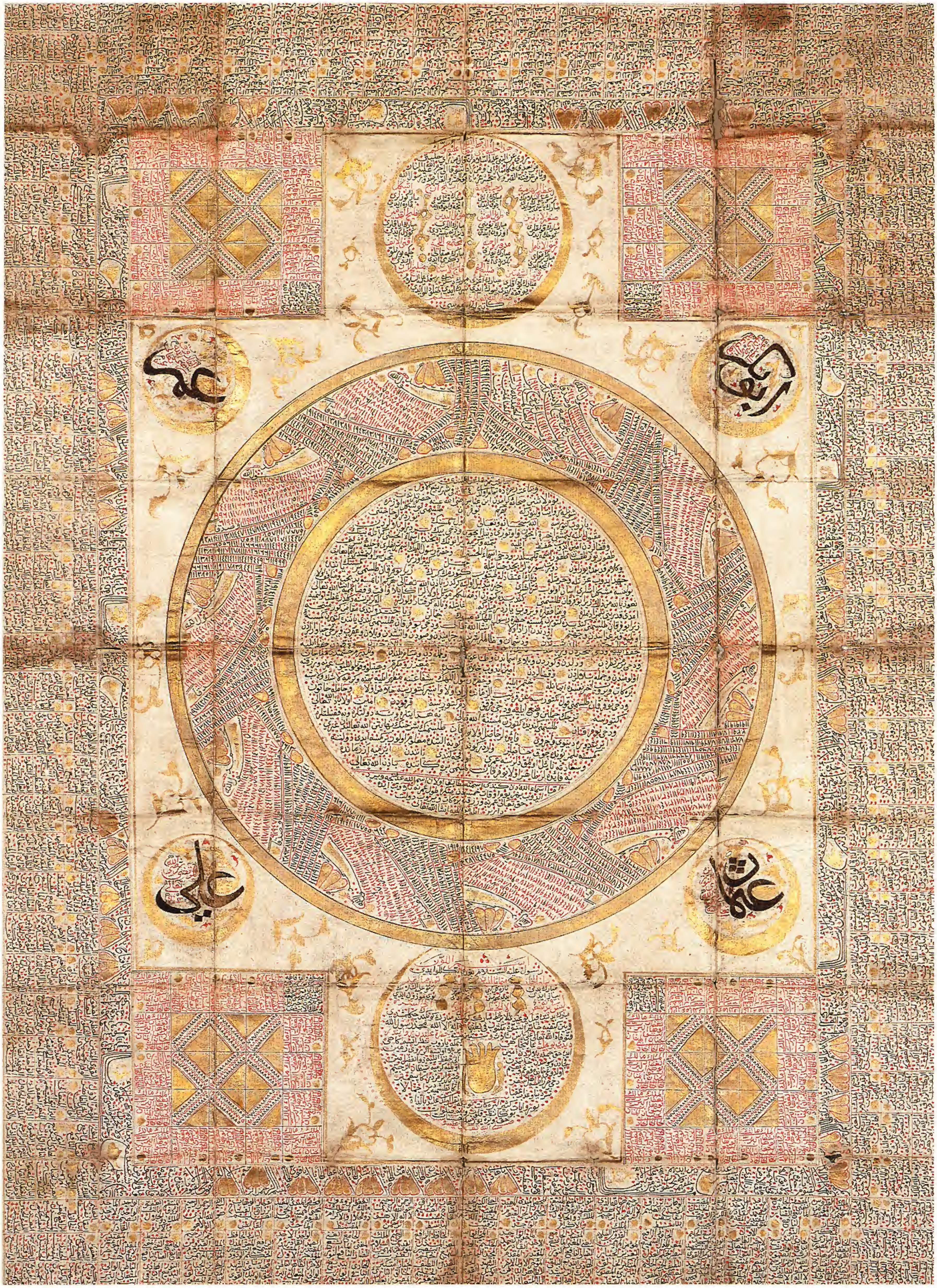
The ring surrounding this central inscription has a repeated Arabic prayer for Muhammad and his family, with lines of numerals filling the swirling spaces. Above and below the central circle are two medium-sized circles formed of gold lunar crescents. The upper one gives the description of the prophet in Arabic and Turkish. At the bottom of this circle the scribe has written his name. The text in the lower circle concerns the name of the prophet, written in Arabic and Turkish around the *qadam al-nabī* or footprint of the prophet drawn in gold.[10] Four smaller circles, also formed by a gold lunar crescent, are arranged about the central large circle, and written in each is one of the names of the four orthodox caliphs, Abu Bakr, 'Umar, 'Uthman and 'Ali.

In each of the four corners of the central rectangular field there are square diagrams composed of 25 smaller squares. The inner nine squares have diagonal bands of numerals, mostly the numbers 7 and 8, on a dark gold ground. The remaining sixteen squares, forming a border and written mainly in red, are filled with repetitions of invocations. In the square diagram in the lower right-hand corner, however, the name of the patron is written in black ink at top left: 'The owner of this great and precious Qur'anic talisman is the noble prince Mustafa ibn Ibrahim.'

The ground of the central rectangular field is filled with vegetal decorations painted in gold and is framed by a narrow band of writing with irregularly spaced groups of three-petalled decorations filled with gold. Filling the spaces between these decorations are seven repetitions of the 'Throne Verse' from the surah *al-Baqarah* interspersed with invocations to God using the *asmā' al-ḥusnā*.

The periphery of the talismanic chart is occupied by a broad band listing, 18 different times, all of the *asmā' al-ḥusnā*. Thus, in this band alone are to be found 1782 of the 1999 'Beautiful Names of God' mentioned in the central inscription. The use of the 99 names several times elsewhere on the chart brings the total close to that specified by the calligrapher.

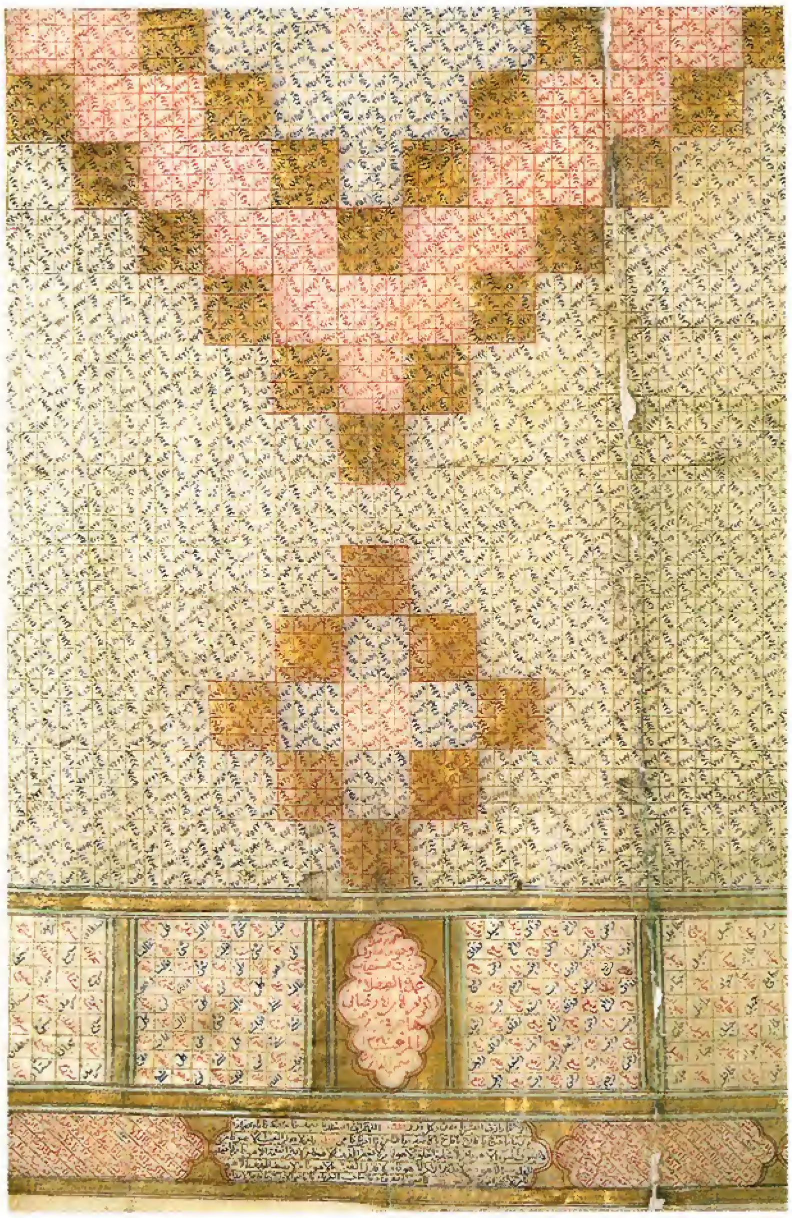
1. The term *fürkan tılsımı*, translated below as 'talismanic document', is not found in the literature regarding amulets and talismans. The word *furqān* means proof or evidence or any criterion that distinguishes between truth and falsity, and is also a name for the Qur'an. In the statement in Arabic giving the patron for whom this piece was made, the talisman is called *al-ṭilasm al-qur'ānī al-'aẓīm al-karīm* ('the great and precious Qur'anic talisman'). There is, however, only one verse from the Qur'an written on this talisman.
2. The *asmā' al-ḥusnā*, the divine names or epithets of God, are usually said to be only 99 in number. In this case the number 1999 must refer to the total number of times they are mentioned on the chart.
3. *Ḥilyah*; for the text of this and a discussion of *ḥilyah*s as a calligraphic art form, see Safwat 1996, pp.104–8 and cat.46–60.
4. In addition to the value given to letters in the *abjad* system of letter-numerals, a letter could also be assigned a numeral according to a system called *al-jummal al-kabīr*. The name of the letter was written down and the *abjad* value of each component letter determined and added together to form the 'higher numerical value' of the letter. Hence the letter *alif* would have the value of 1 in the *abjad* system and a value of 111 in the system called *al-jummal al-kabīr*. See Canaan 1937–8, p.106.
5. *ṭā'ūn*, meaning plague or any pestilential or epidemic disease; the word could also be read as *ṭāghūt*, which means a sorcerer as well as a devil or *jinn*.
6. *damlah* (*ẓamlah*) means a paralytic stroke, according to Redhouse (1890, pp.1246 and 1228), but according to Ayyubi (1985, p.45) it means gout.
7. A hot, dry, violent dust-laden wind of the desert.
8. Children were frequently given a name employing one of the *asmā' al-ḥusnā*, often compounded with other names such as 'Abd; see Schimmel 1989, pp.26–8.
9. The translation given here is by Tim Stanley, with some emendations by the author.
10. For the popular association of talismanic value with the impression of the Prophet's foot, see Schimmel 1985, pp.42–3. For a different interpretation of this feature as the hand of Fatimah, see Geneva 1995, cat.181; Safwat 1996, cat.47.


ابوبكر
عمر
عثمان
علي

44

Talismanic chart

Iran, dated Rajab 1337
(2 April–1 May 1919)



44, detail

Parchment, perhaps gazelle skin, 76 × 48.3 cm, with texts written within an area 74 × 46 cm, in *naskh* script in black and red inks on natural and gold grounds within panels defined by gold and (faded) green lines and subdivided by gold, black and red lines
accession no. MSS 755

The upper third of this talismanic chart is defined by a broad band with a gold ground set with a series of lozenges with scalloped edges and small discs, the latter containing invocations to God. The rectangular area enclosed by this band has a circular figure in each corner. The figures all have a border containing the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255), and the centres are divided into four registers, one containing 19 magical lunette sigla[1] and three containing corresponding *abjad* letter-numerals. At the centre of the top is a large, 20 × 20 numerical magic square, and to the left, a 10 × 10 square with two verses from the surah *al-Tawbah* (IX, verses 128–9) repeated several times up and down the cells, every other word or phrase being written in red or black. These read, 'Ardently anxious is He over you: to the Believers is He most kind and merciful. But if they turn away, say: "God sufficeth me: There is no god but He: on Him is my trust, — He the Lord of the Throne (of Glory) Supreme!"' To the right is a 10 × 10 Latin square employing those names among the *asmā' al-ḥusnā* that begin with the letter *qāf*. Beneath each of the last two squares is a 4 × 4 magic square.

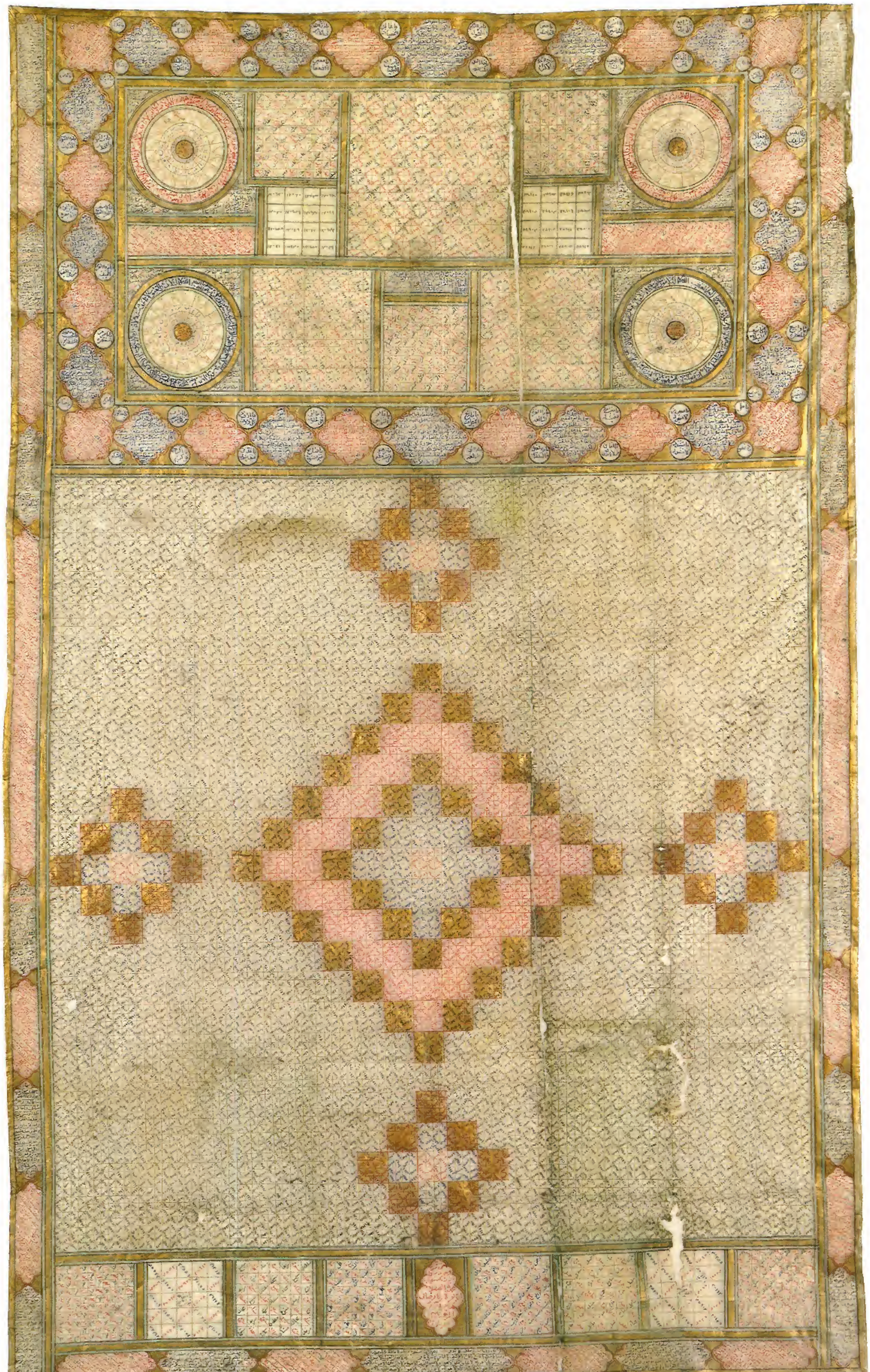
Below them, two 16 × 16 magic squares flank a 10 × 10 Latin square composed of the 'crowning words', that is, the groups of letters that begin some of the surahs of the Qur'an and to which mystic significance is attributed. The text serving as a ground around the circles and within the thin rectangles between the squares contains prayers and invocations. These are numbered from 1 to 100, beginning in the upper right-hand corner of the square containing the upper right-hand circle. After filling the ground between the circles and squares, they continue in the scalloped square lozenges in the frame, starting from the upper right-hand corner and proceeding anticlockwise. After completing the circuit the prayers then continue in the cartouches of the border that surrounds the whole composition on three sides, proceeding in a clockwise direction and ending in the upper left corner.

The lower two thirds of the talisman are dominated by a composite 100 × 100 magic square, with 10,000 individual cells delineated by gold lines. The overall square is divided into 25 sub-squares, each of which is a 4 × 4 magic square whose sum is 20,002. The common sum of the rows, columns and diagonals of the larger 100 × 100 square is 500,050. The positioning of the numerals in this gigantic square differs from that employed in the 100 × 100 magic square on cat. 46 and 47, although their common sums are the same. It would seem that the patterns created using gold grounds and red ink on cat. 44 were purely decorative, since they have no particular numerical significance in the overall magic square.

Beneath the 100 × 100 magic square there is a row containing eight smaller squares. The two at the right and left outside corners are Latin 10 × 10 squares, one repeating the *asmā' al-ḥusnā* that begin with the letter *'ayn* and the other those names beginning with the letter *fā'*. Next to these two squares are two 5 × 5 magic squares, with the centre cell containing invocations rather than a numeral. The middle four squares consist of three Latin squares using the *asmā' al-ḥusnā* that begin with the letters *jīm*, *rā'* and *sīn*, and a fourth, verse square whose cells are filled with a pious statement to the effect that a person will prevail over circumstances only if God wishes. The lobed figure at the centre of this bottom row contains the statement, 'For the well-being of the blessed existence of his gracious lordship, the pillar of the virtuous [and] the noble, Aqa Riza ibn Hajir in the month of Rajab 1337 (2 April–1 May 1919), Shams al-Dhakirin.'

The chart was at one time folded into a packet measuring 6.7 × 10.5 centimetres and placed in an amulet case. A similar talismanic chart, made of gazelle skin and measuring 72.5 × 59 centimetres, was made for the Qajar ruler Muzaffar al-Din (*reg.* 1896–1907).[2] It is likely that cat. 44 came from the same workshop.

1. See Canaan 1937–8, pp. 141–3; Doutté 1908, pp. 158–9, 244–8, 288.
2. Sotheby's, London, 21 October 1993, lot no. 128.

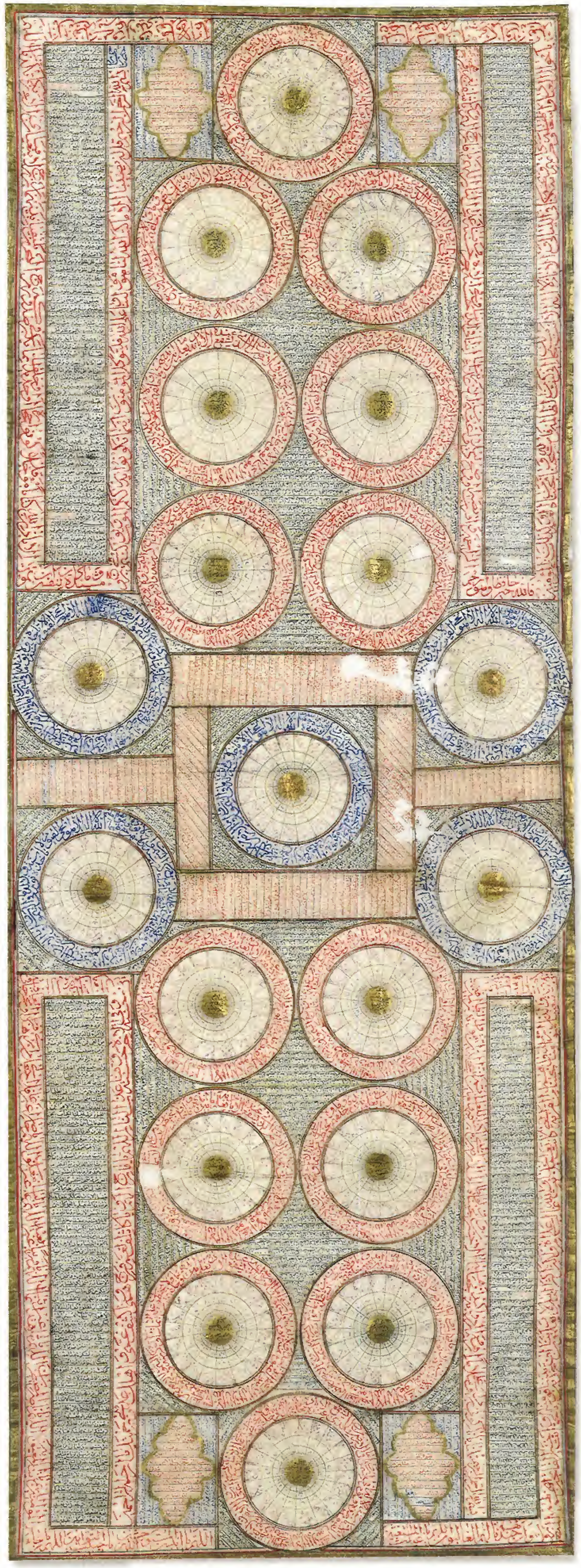


45
Talismanic chart
Iran, *circa* 1900

Parchment, perhaps gazelle skin, 63 × 24 cm, written surface 60.7 × 21.5 cm framed by blue, black, gold and red lines; texts in ***naskh*** script in black, red and blue inks on natural and gold grounds within panels defined by gold, black and red lines and subdivided by gold lines
accession no. MSS 756

This undated talismanic chart appears to be from the same workshop as cat. 44. At one time it was folded into a rectangle measuring 4.5 × 8.5 centimetres. It is divided into two identical parts, both containing seven circular diagrams. These circles have the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255) written in red ink around the circumference, with four inner rings divided into 19 compartments; one ring has 19 magical lunette sigla and the other three contain letters, all written in gold.

At the centre of the panel are five more identical circles, with the 'Throne Verse' written in blue ink. The text in black ink that fills the ground around the circles and the area within the rectilinear frames, as well as the text written in red within the narrow rectilinear frames and the four scalloped lozenges, consists of prayers and invocations to God.



45

46

Talismanic chart

Iran, 19th century

Parchment, perhaps gazelle skin, 83.5 × 72 cm, written surface 80 × 68 cm framed by blue, black, gold and red lines; texts in *nasta'līq* and *naskh* scripts in black ink within panels defined by lines in blue, black, gold and red or black, gold and green, and subdivided by gold and blue lines
accession no. MSS 734

This undated talismanic chart from Qajar Iran has creases indicating that it was once folded into a rectangle measuring about 17 × 11 centimetres and placed in an amulet case.

The narrow upper panel, occupying about one-eighth of the chart, is framed by invocations and prayers. The circles at either end each consist of five concentric rings divided into 19 sectors. The outer ring has magical lunette sigla and the inner rings contain letters of the alphabet. The centre circle has the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255) in the outer ring, with an inner ring of lunette sigla and three rings of letters. In the centre of the circles the invocations *Yā Allāh* or *Yā huwa* (both meaning 'O God') are written.

Between the right-hand circle and the nearby 4 × 4 numerical magic square are written the phrases 'There is no god but God' and 'O Ruler, the Watchful One'. Beneath are the seven magical signs, often incorrectly called the Seven Seals of Solomon, representing the name of God, with the usual star represented here by the interlaced lunettes near the lower corners of the magic square.[1] Between the magic square and the centre circle there is a quotation from the surah *al-Dhāriyāt* (LI, part of verse 58), 'Who gives (all) sustenance, — Lord of Power, — Steadfast (forever)' with magical letters beneath.

To the left of the central circle, an inscription reads, 'He is Living, the Eternal', beneath which there is a six-pointed star bearing magical letters. Between the left-hand circle and the second 4 × 4 magic square is the inscription, 'Only God, only God, only God, King of Kings, Possessor of Majesty and Generosity.'

The square lower panel, occupying the majority of the chart, has around the periphery a narrow band of prayers and invocations to God in which this talisman is referred to as *ḥijāb al-nūr* ('the amulet of light'), probably because God is frequently invoked in the inscription by His divine name 'The Light' (*al-nūr*) and His light and guidance are sought.

The centre of the lower panel is filled by an enormous field containing a composite 100 × 100 magic square, containing numerals in each row and column, resulting in a field of 10,000 individual cells. The overall square is divided into 25 sub-squares outlined in blue ink. Each sub-square forms a 4 × 4 magic square. A random examination of a few of these sub-squares indicates that in each row, column and diagonal, the sum of the numerals equals 20,002. If this is indeed consistent throughout the chart, then in each of the 100 rows and columns and the two diagonals, the sum of the numerals equals 500,050.

1. See p.60 above; see also Kriss & Kriss-Heinrich 1962, pp.74–82; Doutté 1908, pp.154–7; Winkler 1930, pp.55–149; Canaan 1937–8, pp.144–5.

47

Talismanic chart

Iran, 19th century

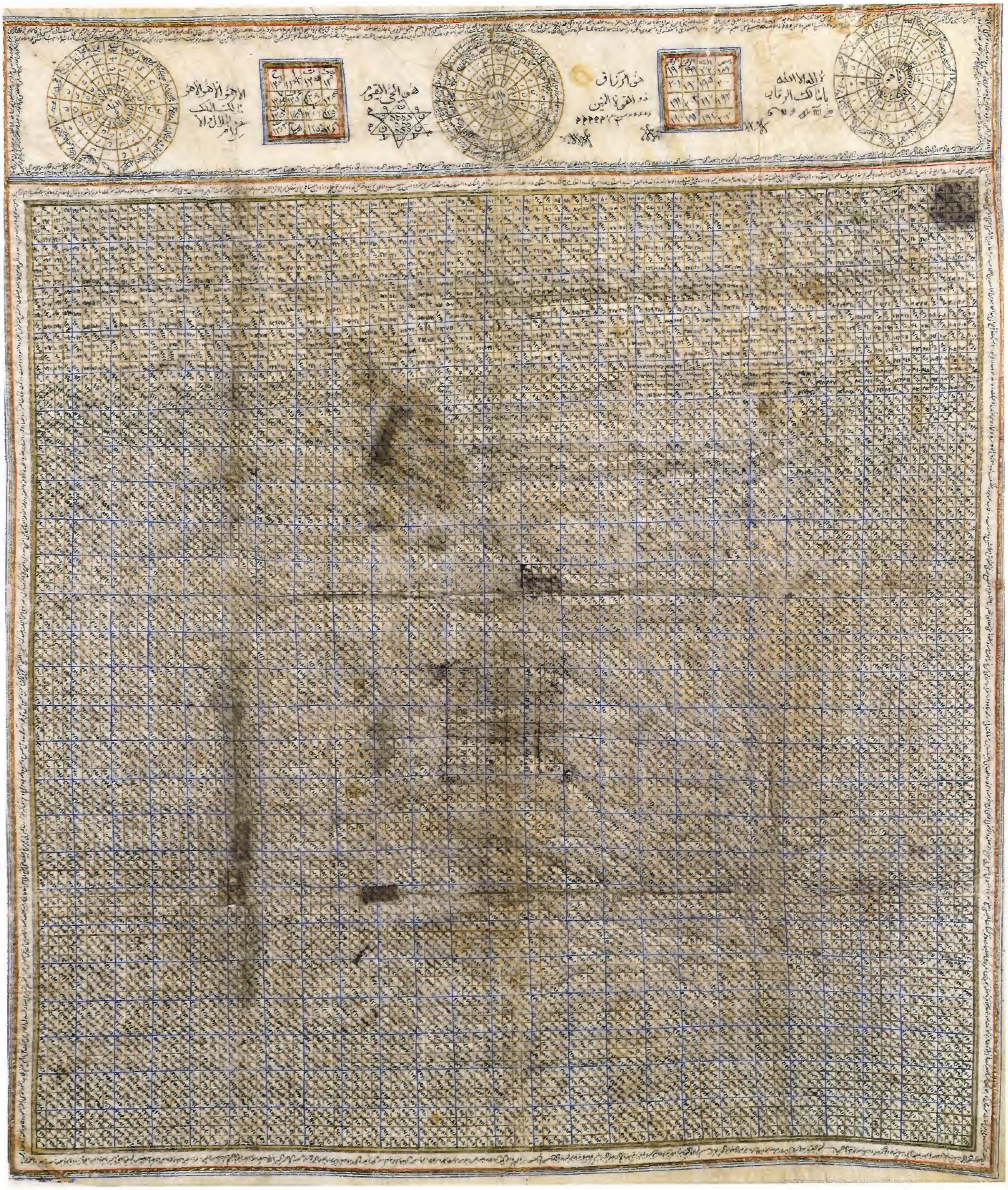
Parchment, perhaps gazelle skin, 73.5 × 60 cm, written surface 71 × 57 cm framed in blue, gold and red; texts in *naskh* script in black ink on natural and gold grounds within panels defined by blue, gold and red lines and subdivided by gold and blue lines
accession no. MSS 735

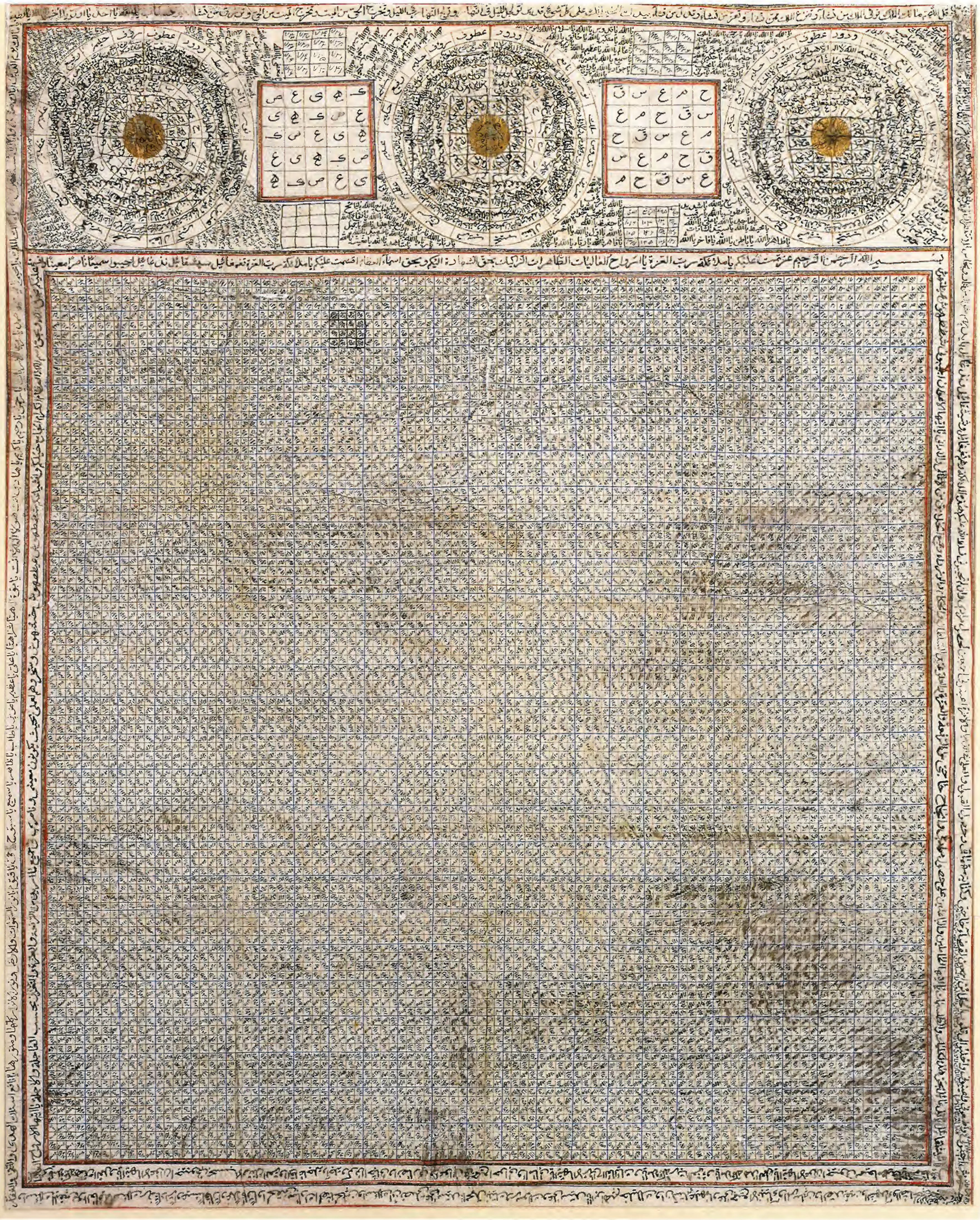
This undated talismanic chart was probably made in the same workshop as cat.46.[1] Creases on the chart suggest that it was once folded to a size of about 15 × 17 centimetres.

In the upper segment there are three circles with seven concentric rings: in the outermost ring some of the *asmā' al-ḥusnā* are written; the two rings within it contain the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255); lunette sigla fill the fourth ring; and letters in the innermost three rings surround a gold central disc. The two squares in the upper segment of the chart are of the order 5 × 5, rather than 4 × 4 as found on cat.46; they are Latin squares employing the 'crowning words', the groups of mystical letters that begin the surahs *Maryam* (XIX) and *al-Jāthiyah* (XLV).

Over each circle a later hand has written a magic square and a surrounding magical text, which are largely illegible. The ground around the three circles and the two Latin squares has also been filled in by a later casual hand with additional magic squares, one of which is incomplete, and with densely written invocations to God, including the following statement in the right-hand corner: 'O God, protect the owner of this large chart [*lawḥ*] from all misfortune and diseases and plague [*wabā'*], from the evil eye and harm, and from the evil of the cursed devil.'

Around the outside edge of the chart is a lengthy prayer and invocation to God, while more invocations are written in an inner frame surrounding the lower panel. The lower panel contains the same composite 100 × 100 magic square that is found in cat.46.





48

Talismanic chart

Iran, dated AH 1300 (AD 1882–3)

Paper, 17 × 10 cm, written surface 14.7 × 7.5 cm, framed by blue, black, gold and red lines; text in *riqā'* script in gold, red and blue on blue and gold grounds within panels defined by black, gold, green, blue and red lines; intervening areas illuminated with stylized floral motifs in gold, orange, red, green and pale blue on gold and natural grounds
accession no. LAQ477
published Khalili, Robinson & Stanley 1996, cat.no.147

This illuminated talismanic chart is mounted on the inside of one of the covers of a double mirror case. The exterior of the case has fine flower-and-bird paintings by Muhammad 'Ali Shirazi, surrounded by poems extolling the mirror in quasi-religious terms.

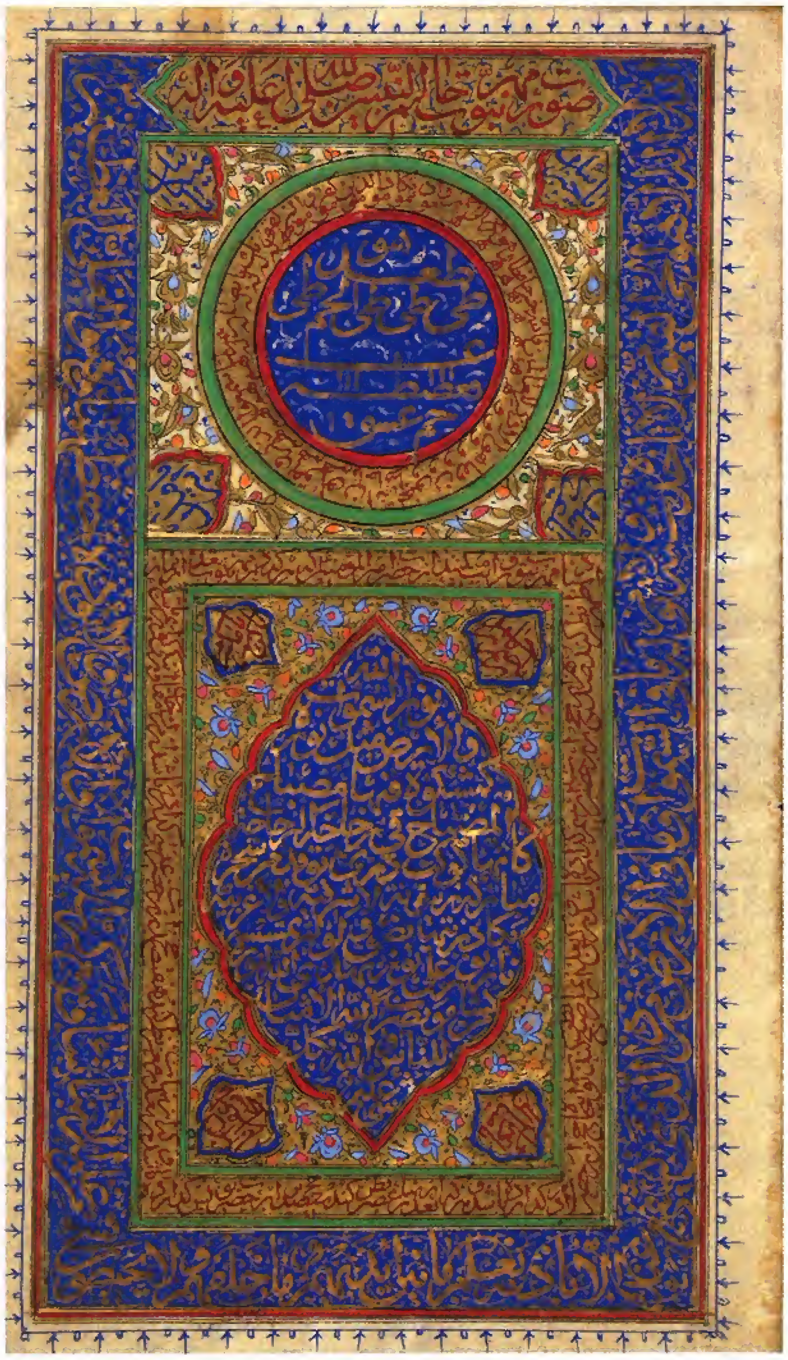
The talisman has a title written in the cartouche at the top of the chart. It reads, 'The form of the Seal of Prophethood [*muhr-i nubuvvat*] of the Seal of the Prophets[1] – May God bless him and his family!' A broad band forms a frame on three sides and encloses the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255), followed by the date AH1300 (AD1882–3) written in the upper left-hand corner.

The enclosed rectangle is divided into two unequal fields. In the upper section there is a large disk filled with undeciphered magic letters, which are apparently intended to be the 'Seal of Prophethood' referred to in the title of the talisman. Several talismanic designs were popularly associated with the Seal, which was said to be a form of mole or growth located between the Prophet Muhammad's shoulder blades.[2] In the gold ring surrounding this disk there are inscriptions in two registers. The inner register consists of a circle of magic letters, with the expression *Yā ḥāfiẓ* ('O Preserver!') at the base, while the outer register contains verses 51–52 from the surah *al-Qalam* (LXVIII) and verse 64 from the surah *Yūsuf* (XII). A narrow green ring encloses these quotations. In the four corners of this upper area are devices with the names of the four archangels, Jibra'il, Mikha'il, Israfil and 'Azra'il.

In the lower and slightly larger field, the blue scalloped medallion contains verse 35 from the surah *al-Nūr* (XXIV). The four small medallions surrounding it contain invocations to God in the form of some of the *asmā' al-ḥusnā*. This composition is framed by a band with a gold ground containing a Persian inscription which begins at the upper right-hand corner, reads across the top and then down the right side and around to the upper left-hand corner: 'It is reported in the documents regarding the Seal of Prophecy from the Commander of the Faithful, that whoever looks at the Seal of Prophecy after the midday prayer will be as if he performed 100,000 pilgrimages before Abraham, and whoever looks at it after morning prayer will be rewarded as if he had performed 50 pilgrimages before Adam, and whoever looks at it after the afternoon prayer will be as if he had performed 300 pilgrimages before Jonah, and whoever looks at it after the evening prayer will be as if he had performed 700 pilgrimages before Jesus, and would be safe from sudden death and suffering in the grave.'

This particular design for the Seal of Prophethood is not referred to in the published literature on talismans. The talismanic chart also contains several elements that are found in amulets invoking assistance, particularly from the prophet Muhammad but also from other Qur'anic prophets such as Adam, Abraham, Jacob, Joseph, Jonah and Jesus.[3]

1. *Khātam al-nabiyyīn*, i.e. the last of the prophets, Muhammad.
2. See above, p.106.
3. See Canaan 1937–8, pp.87–8.



48

Closely related to the large paper and parchment talismanic charts discussed above (see pp. 106–113) are a sizeable group of talismanic shirts. In fact, the same scribes may have been responsible for both types of talisman. At least four distinct types of Islamic talismanic shirt, none datable to before the 15th century, can be identified – Ottoman, Safavid, Mughal and West African. The Khalili Collection has examples of both the Safavid and the Mughal types.

Ottoman talismanic shirts

The earliest dated talismanic shirt known is one produced for the Ottoman prince Cem Sultan; it took three years to make, from 1477 to 1480.[1] Its form is typical of the Ottoman type, referred to in Modern Turkish as *tılsımlı gömlek*. It is made of a thin, polished cloth, with a circular neckline, narrow sleeves and flaring sides. It is, however, shorter than most Ottoman talismanic shirts. The surface is covered with a large number of magic squares of various sizes, none of which is larger than 20 × 20, and other magical symbols, in addition to a selection of 12 Qur'anic surahs, the 99 *asmā' al-ḥusnā* and the names of angels. Of similar design are a shirt made for Şehzade Selim in AH 972 (AD 1564–5);[2] one produced in AH 991 (AD 1583);[3] another, made for the Grand Vizier Kara Mustafa Paşa in 1684 and in which he was buried at Belgrade in 1687;[4] and several undated Ottoman examples.[5] All of these shirts are festooned with a number of different magic squares as well as Latin squares and six-pointed stars filled with script. Qur'anic verses play a minor role in their design.

One of the most magnificent Ottoman examples is an undated shirt that was undoubtedly made for Sultan Süleyman the Magnificent (*reg.* 1520–1566).[6] It is of slightly unusual shape in that it is much longer than usual; it opens all the way down the front and has very tapered, elbow-length sleeves. It is made of linen, lined with cotton and faced with pink silk. The calligraphy employed in writing the selection of Qur'anic verses, the one Latin square containing words from the surah *al-Fatḥ* (XLVIII), the calligraphic decorations, the scrolls and the illuminated lozenges on the shirt are all reminiscent of those on ornate manuscripts.

Safavid talismanic shirts

There are shirts, of a different cut and design to the Ottoman examples, that are probably Safavid products. They are square cut and have Shi'i prayers and the names of the Twelve Imams written on them. They also display a more limited use of colour. Like the Ottoman shirts, however, they bear magic squares of various sorts and a selection of verses from the Qur'an.

The Khalili Collection includes two such shirts, cat. 49 below, and another, undated, example (TXT76, ex-catalogue) that was also probably made in the 16th or 17th century.[7] Magic squares dominate the design of both shirts, but are presented in a less cluttered fashion than on the Ottoman examples. One of the shirts, cat. 49, employs mostly numerical magic squares, including one 40 × 40 square on the back, while cat. 49 contains 'verse squares' filled with Qur'anic verses as well as eight 4 × 4 magic squares, in which the first row is filled with words rather than numerals. There are no dated Safavid talismanic shirts recorded, and only these two have been published, though others are known to be in private collections.

Mughal talismanic shirts

The third group of Islamic talismanic shirts are those made in Mughal India in the 16th and 17th centuries. Sometimes called a *Qur'ān jāma*, a shirt of this type is distinguished from all others by the fact that it has no magic squares at all, but rather all 114 surahs of the Qur'an, in addition to the 99 *asmā' al-ḥusnā* and the *shahādah*. One Qur'anic verse, from the surah *Yūsuf* (XII, verse 64), is singled out and repeated prominently in a large cartouche on the back of the garment: 'But God is the best to take care (of him), and He is the Most Merciful of those who show mercy!' All Mughal talismanic shirts are square cut, and the arms are usually formed from separate rectangular pieces of cloth.

Cat. 50 is typical of Mughal talismanic shirts, which maintain much greater consistency in design and colour than shirts produced in other areas of the Islamic world. The cloth is always worked with black, blue, red and gold paints. The arrangement of the text and decorative medallions is nearly the same on all the known examples,[8] the only obvious difference being that some have lower borders on the front and back, formed of rectangles ending in round scalloped edges, while others have rectangles terminating in triangular points, and there are slight variations in the decorations in the epaulette cartouches.[9] All but one are undated and provide no clues as to precisely when or where they were produced.[10] The one exception is a shirt that was made for, or possibly by, one 'Abd al-Mughni, in a year that is not entirely legible.[11] The third numeral in the year is indistinct, so that the date can only be read as 4 Dhu'l-Qa'dah AH 11[?]5, that is, sometime between 1693 and 1780. In addition to all the texts normally found on other Mughal talismanic shirts, it has the 16 triangular points – filled with magic numerals and symbols – on the lower border of the garment. The script and the band containing the *asmā' al-ḥusnā* differ slightly from other examples, and the garment is open the entire length of the front.

Talismanic garments from West Africa

A fourth type of Islamic talismanic garment is represented by a set of undergarments, comprising a man's shirt and underpants, made in Senegal, and a sleeveless flared tunic made in Nigeria. Both are of relatively recent date.[12] The cut of the shirt in the Senegalese set of undergarments is also sleeveless, but with a square neck and an unfinished, straight bottom. Both the back and front of the shirt have three columns of squares intermixed with text. Only two of the squares are magic squares (each 4 × 4); the rest are Latin squares formed of letters or magic symbols, or squares filled with various magic diagrams and sigla. Invocations to God, the names of the four Orthodox Caliphs, names of angels, the 99 *asmā' al-ḥusnā* represented by their numerical values, and Qur'anic verses make up the rather casually inscribed text. The underpants are similarly covered with prayers, Qur'anic verses and large magic squares of various sorts.

The Nigerian tunic has a design on either side and below the narrow slit neckline, consisting of four triangles surrounding a circle that contains Qur'anic verses. Near the bottom of the front of the tunic are two large circles in which are written invocations to God, and on the upper back of the garment there is an elaborate design formed from triangles and squares, including four 3 × 3 magic squares with the word *Allāh* in the central cell. The ground around all these designs is covered with Qur'anic verses, prayers and magical symbols. Several small leather amulet cases, probably containing additional extracts from the Qur'an, are sewn to the inside of the garment.

Function

There appears to be no mention of such elaborate talismanic shirts in the magical or medical literature, and their use can only be surmised from their present condition and references to them in other writings. Determining on what occasions such garments were worn is therefore problematic. A number of the shirts preserved today were in fact never finished and lined, much less worn. Creases in many of them indicate that they were folded and refolded to fit into containers, probably amulet cases,[13] being viewed and used in much the same way as the large paper talismans.

Other garments have been finished and lined and occasionally show soiling from wear. Whether most of the shirts were intended as undergarments worn next to the skin or as outer garments is not entirely clear. The elegant and rather long shirt made for Süleyman the Magnificent was probably created as an outer, ceremonial garment. Most of the others may have been intended as undergarments, as the Senegalese ones certainly were, though some are quite full and could have been worn over other items of clothing.[14]

It has been argued that the primary function of such shirts was to ensure victory in battle. The Ottoman shirt made for Şehzade Selim bears a statement in Persian to the effect that the surah *al-Fatḥ* (XLVIII) was written on it 'for the sake of victory'. An important piece of evidence for this kind of use is a letter written in the 1530s by Hürrem Sultan (Roxelana) to her husband, Süleyman the Magnificent, who was apparently away on a campaign. With the letter she sent a shirt which, she said, had been brought to Istanbul from Mecca by a holy man. According to the letter, the holy man had inscribed the shirt with names for use in the holy war, following directions given by the Prophet in a vision. Hürrem Sultan urged her husband to wear the shirt, for 'it had sacred names woven in it and would turn aside bullets.'[15] The shirt mentioned in Hürrem Sultan's letter is not, however, the magnificent garment made for Süleyman mentioned above, for the latter was clearly intended for ceremonial use and in any case shows no sign of wear. Nonetheless, it is evident from the letter that members of the Ottoman court employed some type of talismanic garment to protect the person in battle.

Whether the use of these garments, of whatever type – Ottoman, Safavid or Mughal – was exclusively military is not certain. The magic designs and textual content of the garments provide few clues as to their use. The selection of Qur'anic verses occurring on the Ottoman and Safavid examples are typical of talismanic objects regardless of their purpose, be it protection from disease, war, famine, difficult childbirth, sudden death or the unpredictability of travel. Indeed, the verses on the shirts usually include those considered to be universally efficacious: the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255), the opening surah of the Qur'an and the final three surahs. Only the earliest shirt, made for Cem Sultan, has any of the Qur'anic verses usually associated with war in

the magical treatises.[16] For the rest, the verses were selected from those considered generally beneficial on a variety of occasions, including surahs *al-Nūr* (XXIV), *al-Shu'arā'* (XXVI) and *al-Fatḥ* (XLVIII). While the fact that all or part of the surah *al-Fatḥ* is found on many, though not all, of the Ottoman and Safavid shirts might indicate a military use,[17] it should be noted that the surah is found on other talismanic objects, including magic-medicinal bowls, and that in the magical treatises it does not play a large role in the design of talismans useful for defeating enemies.[18] On the talismanic shirts it is always one amongst a number of Qur'anic verses, all of them providing protection against life's misfortunes and success in new undertakings, by the grace of God. On the other hand, the thrice-repeated line from the surah *al-Ṣaff* (LXI, verse 13), 'Help from God and a speedy victory', found on the Safavid shirt cat.49, and on the Ottoman one made for Cem Sultan, reinforces the hypothesis that the primary intent of at least these two shirts was to assure success in battle.

In the case of the Mughal shirts, on which all the verses of the Qur'an are included, text from the surah *al-Ḥashr* (LIX, verses 22–3) is repeated before the *asmā' al-ḥusnā*, while text from the surah *Yūsuf* (XII, verse 64) is repeated in the large cartouche on the back of the garment. These verses yield few clues, however, as to the intended use of the garment, being generally concerned with guarding and refuge.

It is not unlikely that these shirts were considered useful for other objectives as well as protection from injury and victory in battle. It should be noted, for example, that the verses from the surah *al-Ḥashr* that are repeated on the Mughal shirts but lacking on the Ottoman and Safavid ones were commonly (though not exclusively) associated with talismans and amulets employed against disease. Consequently, it has been suggested that these garments had a medical application as well as providing general protection from evil forces.[19] Such a view seems reasonable given the medical uses, as well as generally protective functions, specified on some of the large talismanic sheets.[20]

An older tradition of using garments with talismanic writing on them for various purposes is recorded by al-Buni, for example, who mentions that a shirt (*qamis*) can be used to gain the affection of a person by writing a specified magical design on its collar and pronouncing over the design an invocation to God based on the *asmā' al-ḥusnā*, followed by the phrase 'seek the heart of' followed by the name of the beloved.[21] In the case of the West African undergarments, it has been suggested that they were intended to obtain the love of someone or to gain political and social favour.[22]

1. Topkapı Palace Museum, Istanbul, inv. no.13/1404; Istanbul 1983, no.E25. It was begun on 14 Dhu'l-Hijjah 881 (30 March 1477) and work on it stopped on 16 Muharram 885 (29 March 1480); it remained unfinished and unused, for the neck was not cut out and it was not lined. It may be, however, that the inscription giving this information is not reliable, for an extravagant claim over the time taken to produce the shirt mayhave been made to enhance its value. A similar claim – to a production time of three and a half years – is found on a 17th-century Safavid magic-medicinal bowl (see p.77, above).
2. Topkapı Palace Museum, Istanbul, inv. no.13/1133; Atıl 1987, no.123, p.198; Rogers & Ward 1988, no.111, pp.175, 177. The maker or possibly the calligrapher is given as Derviş Ahmed ibn Süleyman.
3. Collection of Theron J. Damon; Pope 1945, pl.153, who incorrectly described it as 'Safavid' (p.187).
4. The shirt was in the Musée de la Ville, Vienna, but was lost in 1945, and its present location is unknown. See Demonsablon 1986, pp.200–229 for a detailed discussion based on photographs and an earlier study by Joseph Hammer von Purgstall.
5. For a shirt in the museum of the Cistercian convent in Vienna, see Demonsablon 1986, pp.230–37. An Ottoman shirt of the same cut, but noticeably lacking magic squares and with more Qur'anic verses, prayers and the *asmā' al-ḥusnā*, was offered for sale at Christie's, London, 24 April 1990, lot no.153.
6. Topkapı Palace Museum, Istanbul, inv. no.13/1150; see Atıl 1987, no.122, pp.196–7; Rogers & Ward 1988, no.110, pp.175–6. Two additional talismanic shirts, quite similar in cut and calligraphic design, are in the same museum, inv. nos 13/1408 and 13/1830; Istanbul 1983, no.E27; Sydney 1990, no.27.
7. These two shirts were published in Alexander 1992, cat.nos 33 and 34, but the first paragraphs of the two entries were exchanged in error, and the plates were mislabelled as a consequence: p.79 shows TXT76 (no.33) and pp.80–81 show TXT77 (no.34).
8. See an unpublished shirt in the Bodleian Library, Oxford, MS.Bodl. Or.162a; and those offered for sale at Christie's, London, 28 April 1992, lot no.78; Sotheby's, London, 22 October 1993, lot no.38; and Christie's, London, 27 April 1993, lot no.38. See also Fehérvári & Safadi 1984, pp.240–41, no.164. The latter was catalogued as a 15th-century shirt made under the Delhi Sultanate, and a similar attribution was made in the catalogue of a sale at Spink & Sons, London, 21 November 1986, lot no.78. Comparison with other examples, however, suggests that it is also a Mughal product no earlier than the 16th century.
9. Some epaulette cartouches, such as those on the shirts illustrated by Fehérvári & Safadi and in the Bodleian (see note 8, above), have devices filled with a chequerboard design reminiscent of that used on the sleeves of the unusual Ottoman shirt offered for sale at Christie's (see note 5, above). It is possible that this particular shirt, which lacks the magic squares that are otherwise typical of Ottoman products while maintaining the flared cut and typically Ottoman calligraphic panels, may represent a transitional design.
10. The talismanic shirt in the Bodleian Library, Oxford, MS.Bodl.Or.162a, was given to the library by the London merchant Richard Darydge in 1653, which provides a *terminus ad quem* for its manufacture. Since the shirt was never lined and worn, it is likely that it was purchased shortly after it was made.
11. See Christie's, London, 21 November 1986, lot no.84.
12. For the Senegalese set, see Hamès & Epelboin 1992. For the Nigerian tunic, see Picton & Mack 1989, p.164; Tokyo 1991, no.74.
13. For example, Topkapı Palace Museum, Istanbul, inv. no.13/1404; Fehérvári & Safadi 1984, pp.240–41, no.164; and Bodleian Library, Oxford, MS.Bodl.Or.162a. In the first two instances, the neck and front openings remain uncut and creases show how they were folded to fit into a case, probably an amulet case. The shirt in Istanbul was folded to measure about 11 × 14 centimetres, while that illustrated by Fehérvári & Safadi measured 24.5 × 9.3 centimetres when folded. The corners and edges of the folded cloth are badly worn, indicating that the shirt must have been removed and then replaced many times into a tight-fitting container. In the case of the Bodleian shirt, the neck opening was cut out, but the garment was never lined or finished; visible fold lines indicate that it was fitted into a container measuring 14.7 × 23.2 centimetres.
14. See Tezcan, Delibaş & Rogers 1986, p.13 for suggested uses.
15. Rogers & Ward 1988, p.175; Alexander 1992, p.21.
16. These are from the surahs *al-Baqarah* (II, verse 246); *Āl 'Imrān* (III, verse 181); *al-Nisā* (IV, verses 76–7); *al-Mā'idah* (V, verse 31); and *al-Ra'd* (XIII, verses 17–18). According to one authority on magic, al-Nazili, all of these must be written on a talisman to bring success in war; see Canaan 1937–8, p.75. Al-Buni, on the other hand, recommended that verse 9 from the surah *Yā'-sīn* (XXXVI) be written on a shield. On another occasion, he says that the surah *al-Naṣr* (CX) should be written on a piece of blue paper or cloth (*khirqah*) during the exaltation (*sharaf*) of the Sun and Mars, in order to gain victory over enemies and avoid injury (see cat.22, folios 70b–71a and 91a). See Doutté 1908, pp.239–42, for yet different verses. Rehatsek (1874b, p.313, and no.9 on the plate opposite p.301) lists symbols associated with talismans ensuring invulnerability, and these also are missing from the shirts.
17. David Alexander (1992, p.21) notes that the surah *al-Fatḥ* (XLVIII) and verse 13 from the surah *al-Ṣaff* (LXI) occur on armour.
18. The surah is found, for example, on the inside of a Safavid magic-medicinal bowl, traditionally used for aiding childbirth, made for the Twelver Shi'i community; Rehatsek 1874a, pp.39–40. It is also on two non-sectarian magic-medicinal bowls in the Khalili Collection, cat.27 and 29; see also Canaan 1936, p.83. In the 19th century, the first verse of the surah and verse 13 of the surah *al-Ṣaff* (LXI) were used in Egypt as talismans placed over shops (Lane 1836/1908, p. 260). For their occurrence on an all-purpose amulet, see Anawati 1972, pp.296–301. For further examples of its use on items in the Khalili Collection, see Table 1.
19. See, for example, Atıl 1987, p.196. Sympathetic magic is evident in early references to the use of shirts, often sweaty and recently taken from another patient or from a woman delivered of a child, to cure fevers; see Ispahany 1991, pp.60–61; and Ullmann 1978, p.109. In the second half of the last century it was a practice among *fellahin* in Egypt to try to cure children of measles by dressing them in a red silk shirt called *al-qamīṣ al-iskandirānī* ('the Alexandrian shirt'), though they were in fact produced in Edku in the Delta; see Walker 1934, pp.106–107.
20. The severe staining of the underarms evident on some of the shirts, including both TXT76 and cat.49, encourages the speculation that the wearer was suffering from a high fever, though the same results could be produced in battle.
21. See cat.22, folios 27b and 31b.
22. See Hamès & Epelboin 1992, pp.233–4.

49
Talismanic shirt

Probably Iran, 16th or 17th century

Cotton, 76 × 145 cm, written in *naskh* and *riqā'* scripts in red and black ink
accession no. TXT77

This cotton shirt was assembled from two large rectangular pieces, joined at the shoulders, four small rectangular pieces forming the two sleeves and two triangular pieces sewn as gussets under the arms. There is a circular opening for the head and a slit about half-way down the front.

Each piece of material is framed by a wide band containing prayers, invocations and Qur'anic quotations. At the top of the right[1] shoulder a quotation from the surah *al-Ṣaff* (LXI, verse 13), 'Help from God and a speedy victory', is written in red, followed by the names of Muhammad, 'Ali, Fatimah, Hasan and Husayn. On the other shoulder the inscription reads, 'O He who opens, O Opener of the Gates, O God, O Helper, O He who gives victory to the Victorious.' The entire text of the surah *al-Fatḥ* (XLVIII) is written obliquely in black ink, beginning at the upper left corner of the rectangular panel across the front of both shoulders, filling the whole panel from one side to the other and then continuing in the upper rectangular panel of oblique inscriptions across the midriff, finishing near the middle. It is followed by a lengthy profession of faith, including the names of the Imams. The lower panels contain a prayer that includes many invocations to angels.

On the front of the shirt, at the bottom and immediately above the framing band, are three rectangular areas: the left-hand area contains invocations to God using most of the 99 *asmā' al-ḥusnā*, written horizontally in black ink, while the right-hand space contains additional invocations and supplications to God. The central rectangle, inscribed obliquely in red, contains rows of magic numerals intermixed with letters standing for the name of God.

Across the chest of the garment are two large, 24 × 24 verse squares, the one on the right formed of repetitions of a text from the surah *al-Nūr* (XXIV, verse 35). Inside the square, the central 8 × 8 square contains the entire text of the surah *al-Ikhlāṣ* (CXII) written in red ink using a pattern similar to that employed in the larger square. Similarly, on the left-hand side there is a 24 × 24 verse square inscribed with the entire 'Throne Verse' from the surah *al-Baqarah* (II, verse 255), worked in a similar pattern, while the inner area of an 8 × 8 square has the entire surah *al-Naṣr* (CX) inscribed in red.

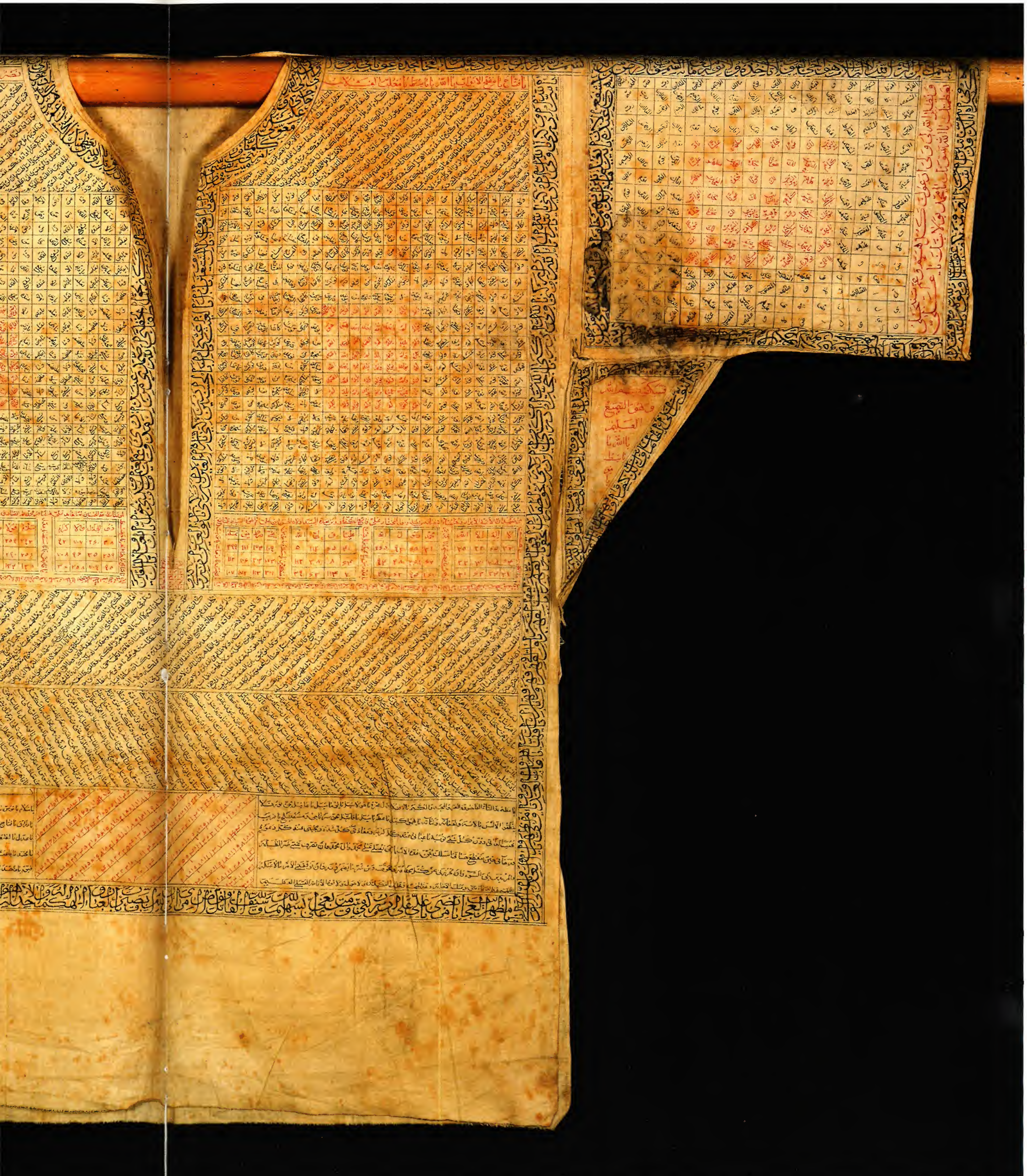
Written in red in the narrow central panel across the front of the shirt are eight magic 4 × 4 squares. In each, the top line consists of words rather than numerals, but the numerical values of each letter forming the word supply the correct numeral for them to be true magic squares. The common sums produced by each square, reading right to left, are 165, 454, 223, 693, 1098, 818, 1302 and 1233.[2] The words forming the tops rows of the squares read, 'There is no god but God'; 'Muhammad is the messenger of God', ''Ali is the sincere friend of God'; 'for a true path we hold fast to him'; 'possessor of majesty and honour'; 'Peace – a word (of salutation) from a lord Most Merciful' from the surah *Yā'-sīn* (XXXVI, verse 58); 'Help from God and a speedy victory' from surah *al-Ṣaff* (LXI, verse 13); and 'Verily we have granted thee a manifest victory' from the surah *al-Fatḥ* (XLVIII, verse 1). Between the squares are invocations using some of the divine names of God, with prayers and Shi'i invocations enclosing the band of squares.

Both sleeves have 16 × 16 verse squares in a pattern identical to that used in the large squares on the body of the shirt. The sleeve to the right has the opening surah written in black, but because the surah is short, letters have been used to fill in the extra spaces. The centre area, forming an 8 × 8 square, contains, written in red ink, the common Shi'i invocation 'Call upon 'Ali, through whom miracles are made manifest. You will find him a help to you when misfortunes occur. All anquish and sorrow will be dispelled through your prophethood, O Muhammad, and through your closeness [to God], O 'Ali.' The sleeve on the left has the complete text of verses 26–7 from the surah *Āl 'Imrān* (III) written in black, while the central square has the phrase 'Help from God and a speedy victory', from the surah *al-Ṣaff* (LXI, verse 13) and the first verse from the surah *al-Fatḥ* (XLVIII). Both sleeves also have a band of red inscriptions running inside the framing band at the open end; these consist of prayers to God, also invoking Muhammad and 'Ali, and, on the left sleeve, the first half of the Shi'i invocation beginning 'Call upon 'Ali, in whom miracles are made manifest'.

The gusset under the sleeve on the right has invocations to God written in red, while that on the left also has some 'crowning letters' of the Qur'an and the line from the surah *al-Ṣaff* that occurred on the left sleeve.

This undated shirt is probably a Safavid product of the 16th or 17th century. Both it and another Safavid shirt in the Khalili Collection, TXT76, show signs of wear and have perspiration stains under the arms. The repetition on cat. 49 of the line 'Help from God and a speedy victory', from the surah *al-Ṣaff* (LXI, verse 13), and the prominent role of surah *al-Fatḥ* (XLVIII) support the suggestion of a military use for this particular shirt.

1. The left side in the illustration.
2. There are in fact errors in seven of the eight squares, only the fifth from the right being correct as it stands. In the first four squares, and the last two, the numerals occupying the centre two positions in the middle row of numerals must be interchanged in order for the squares to be correct. For example, in the first square 30 and 38 must be interchanged. Because this is a consistent pattern at the centre of each diagram, it would appear that this was an intentional error introduced by the calligrapher or the creator of his exemplar. It was not an uncommon practice purposely to make a magic square imperfect. In the sixth square, however, the error concerns two numerals on the bottom row, 191 and 155, which are mistakes for 291 and 255. Because the nature of this error is different, and because the fifth square is correct as written, it is likely that this calligrapher did not intend a deliberate imperfection. Furthermore, in the seventh square the scribe corrected one numeral but left the two central numerals in their incorrect position.



50

Talismanic shirt

Perhaps India, 16th–17th century

Cotton, 140 × 97.5 cm, written in *naskh* and *thulth* scripts in red, blue, black and gold
accession no. TXT87

This shirt was assembled from one large rectangular piece of cotton and two small pieces forming the arms. There is a circular opening for the head and the front is slit for three quarters of its length.

The main field of decoration on the garment contains the entire text of the Qur'an written in a neat *naskh* script. It is densely packed in rectangular compartments defined by red lines with blue and red circular medallions; there are four-petalled white flowers at the intersections of the compartments, and everything is set within a thin blue frame. The Qur'anic text also fills the rectangular spaces, ending in round, scalloped edges, that form the lower borders of the garment.

The first surah begins at the lower corner of the back of the right sleeve, with the first four surahs filling the main field of the sleeve. Surahs V–IX are on the left sleeve; surahs X–XVIII on the main field of the left-hand side of the front of the garment; and surahs XIX–XXIX on the right-hand side. Surahs XXX–LXXIII fill the main field of the back, while surahs LXXIV–LXXXVIII are in the eight scalloped rectangles at the bottom of the front.

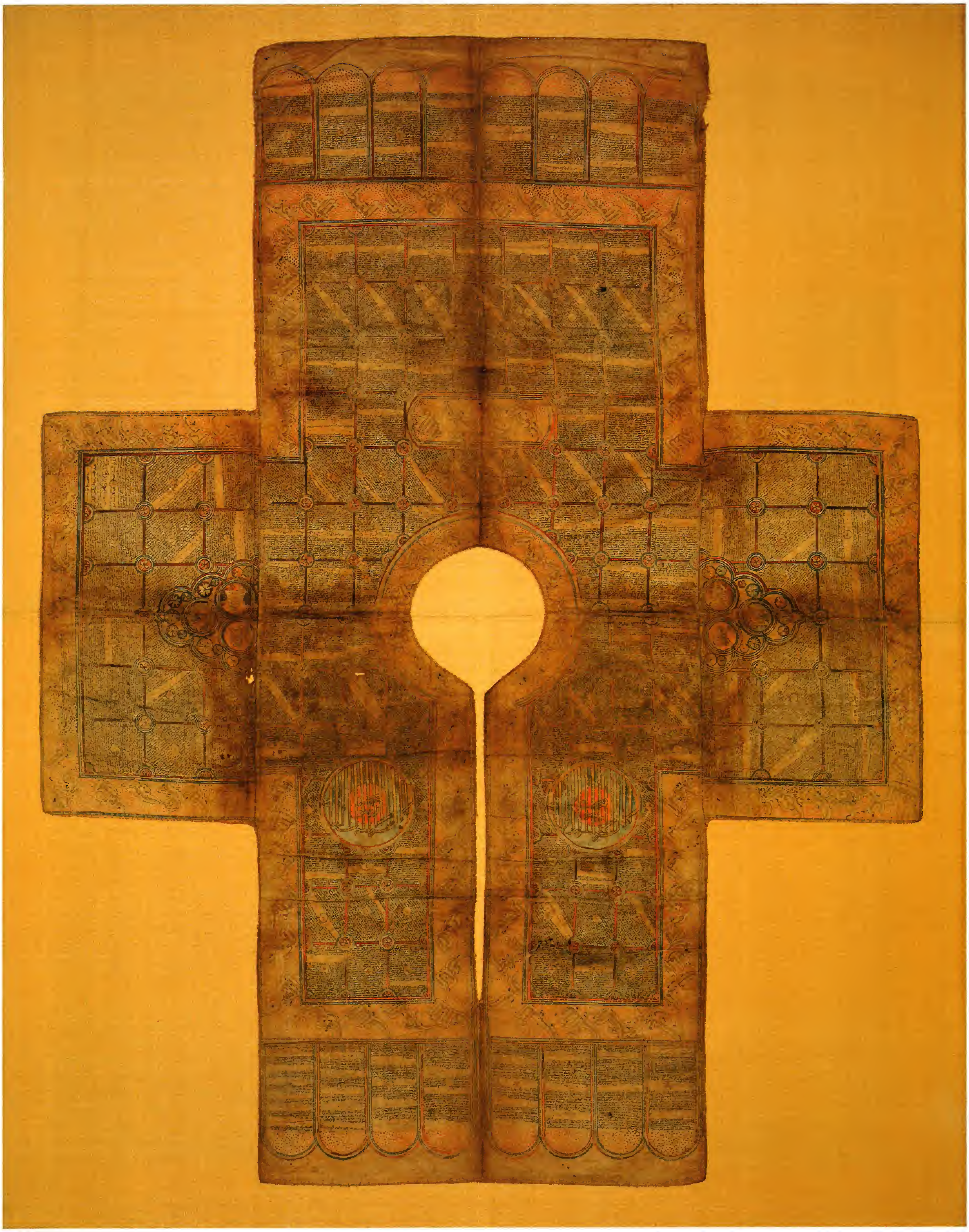
The edges of the sleeves, underarms and sides, as well as the neck edge, front opening and areas between the lower bands of scalloped rectangles and the main field, are delineated by a wide border of red speckled ground in which the first four lines of the surah *al-Ḥashr* (LIX), followed by all the *asmā' al-ḥusnā*, are written in gold inside cloud bands. Following the *basmalah*, the text begins at the lower corner on the back of the right sleeve with most of verses 22–3 from the same surah: 'God is He, than Whom there is no other god; — Who knows (all things) both secret and open; He, Most Gracious, Most Merciful. God is He, than Whom there is no other god; — The Sovereign, the Holy One, the Source of Peace (and Perfection), the Guardian of Faith, the Preserver of Safety, the Exalted in Might, the Irresistible, the Supreme'. This is followed by the *asmā' al-ḥusnā*, which proceed anticlockwise round the garment, ending near the same corner.

On the front of the garment, two large roundels contain the profession of faith, or *shahādah*, written in gold *thulth* script on a ground composed of a small red circle set inside a pale blue one. On the shoulders are epaulette cartouches containing three circles, each with the word *Allāh* written in gold on a red and grey or pale blue ground, surrounded in one case by 12 smaller circles containing white flowers on red or blue grounds, and in the other case by 16 such circles.

On the back of the shirt there is a large oblong lozenge outlined in blue and red; inside it, written in gold in cloud bands on a red speckled ground, are the last of two lines from the surah *Yusuf* (XII, verse 64): 'But God is the best to take care (of him), and He is the Most Merciful of those who show mercy!'

This undated shirt is probably a 16th- or 17th-century Mughal product. It most closely resembles a talismanic shirt recently offered for sale at Christie's[1] and another, illustrated by Fehérvári and Safadi.[2] On the latter, the nature of the some of the script differs slightly and the epaulette shoulder decorations contain some circles with chequerboard designs. In all other aspects of the design, these two shirts are identical to cat. 50, including the rectangular panels forming the lower borders which in these examples end in round, scalloped edges. Other known Mughal talismanic shirts have triangular points rather than semicircular scallops on the edges of the compartments.

1. Christie's, London, 28 April 1992, lot no. 78, a fully lined and well-worn shirt.
2. Fehérvári & Safadi 1984, pp. 240–41, no. 164, incorrectly catalogued as a 15th-century Delhi Sultanate product. This example remained uncut and was never worn as a shirt; rather, it was folded and refolded to fit into an amulet case.



Talismanic mirrors and plaques

The Khalili Collection includes two circular metal talismanic objects, mirrors or possibly plaques, that were made for the Twelver Shi'i community in Safavid Iran or Mughal India. Only one comparable piece seems to have been published – a rather more elaborate item that lacks the prayers for the Twelve Imams and was made for the Muzaffarid ruler of Fars, Kirman and Isfahan, Jalal al-Din Shuja', in AH 777 (AD 1375).[1] Both the examples in the

MSS145, folio 75a, detail

Khalili Collection, cat. 55 and 56, are undated and unsigned products of one workshop. A third similar plate, also undated and unsigned, is now in the Museum of the History of Science at Oxford.[2] The latter has traces of silvering still visible while cat. 56 is made of silver, which suggests that all three objects were originally intended as mirrors. One of the three, cat. 55, has additional holes that were apparently made to attach it to a wall.

All three plates have other holes – at the point where there is a blank space in the peripheral inscriptions – where a handle was once attached; the outline of the handle is still visible on the Oxford example. When the user held the plaque upright, with the handle underneath, the invocations and magic squares could be easily read. The inscriptions are almost entirely vocalized, suggesting that they were intended to be read aloud.

On each plate one side is blank except for a narrow circular inscription containing a Shi'i prayer with the names of the Twelve Imams recognized by the Twelver or Imami Shi'i community. In the centre of the other side is a 30 × 30 square of 900 cells. This is a Latin square, employing the 28 letters of the alphabet, in *abjad* order, with two additional characters – the *hamzah* and *maddah* – making a total of 30 symbols written from right to left in order of sequence across the first line of cells. The same letters are then rearranged in the subsequent cells so as to form a rather interesting overall pattern. Every 5 × 5 group of cells is demarcated by a slightly heavier incised line. Each of these 5 × 5 groups forms another Latin square in which each of five elements is represented five times in different arrangements. The six 5 × 5 squares across the top of the large central square are all different, each being formed from five letters of the 30-letter sequence. These six squares are then repeated in a pattern to form a larger 6 × 6 Latin square, each element of this composite square consisting not of a letter but of a smaller, 5 × 5 square of *abjad* letters. The result is a Latin square of order 30 in which the two diagonals as well as each row and column contain all of the thirty symbols, with no repetitions.[3]

On cat. 55 and the Oxford plaque there are two small 5 × 5 Latin squares to the left and right of the large square, level with its midpoint. The square on the left employs the 'crowning word' opening the surah *Maryam* (XIX), while the one to the right is formed of the 'crowning word' opening the surah *al-Shūrā* (XLII).[4] Above and below the large square are two true magic squares. Numerals are used in the cells, and the 5 × 5 square at the top yields the sum of 65 for its columns, rows and diagonals. The lower 4 × 4 square yields the sum of 34.

The surrounding squares differ on cat. 56, where the two small Latin squares are omitted while the 4 × 4 magic square is repeated four times. There are also four small squares containing undeciphered magical ciphers and twelve roundels of zodiacal signs.

The circular inscriptions ringing the Latin and magic squares are quite similar on the three plaques, with only minor differences. The Qur'anic quotation from the surah *al-Falaq* (CXIII) is omitted from the Oxford plaque and cat. 56. All three state that their primary use is to invoke God's protection from the evil and deceptions of *jinns* and humans, both male and female, as well as protection from pain and illness. The Oxford plaque and cat. 55 add a request for protection from vermin and insects,[5] while cat. 56 includes dementia in the list of general infirmities from which God's protection is being sought.[6]

Illustrations of circular talismanic plaques occur in two manuscript paintings in the Khalili Collection. Both were produced in India: cat. 51 was probably made in Kashmir in the early 17th century, at about the same time as cat. 55 and 56 and the related Oxford plaque; MSS 145 (illustrated left and see above, p. 28) is from a manuscript dated AH 1208 (AD 1793–4). Both are from copies of Firdawsi's *Shāhnāmah*. The first illustrates Kaykavus in his flying machine and shows an astrologer or magician holding a circular plaque by its handle so that the handle is at the top. The plate seems to be inscribed with Hebrew rather than Arabic letters. This is particularly relevant given that the 13th-century authority on the occult, al-Buni, recommended the use of Hebrew letters for charms intended to help the owner walk on water or fly.[7] In the 16th and 17th centuries, Hebrew letters were frequently incorporated into European magical and cabbalistic talismans that may also have been familiar to those at the Mughal court who had contact with Europeans. The other miniature, MSS 145, depicts the birth of Rustam and shows a scholar, possibly a talisman writer, holding a circular plaque that encloses a 3 × 3 magic square, some of whose characters appear to be Arabic numerals, though most are indecipherable. As comparable circular talismanic plaques are not known to have been depicted in Iranian copies of the *Shāhnāmah*, their occurrence in two Indian copies suggests that such plaques were a predominantly Indian tradition.

By contrast, the engraving of talismanic motifs on the reflecting side of much older Iranian mirrors appears to have been a rather common practice, for several are preserved in museum collections today.[8] One of the examples in the Khalili Collection, cat. 52, is more elaborate than most in its talismanic design and is unique in giving the name of the person for whom the re-engraving was carried out – Abu Mihr Kassas, a Shi'i Muslim.

Another example, produced for the Artuqid ruler of Diyarbakır, Abu'l-Fadl Artuq Shah, and thus datable to the late 13th century, includes a talismanic design as part of its original casting, for it has images of the 12 zodiacal signs and an inner ring of seven human heads, possibly representing the seven classical planets. The flat, reflective side of this mirror has no talismanic engraving, however.[9]

Talismanic designs were probably engraved on the flat surface of early

13th-century, handleless mirrors after the surface had lost its reflective qualities. As none of the known examples bears a date, it is uncertain when the custom began. The evidence currently available suggests that the engraving took place among the Shiʿi community in Iran in the 15th century or later. It is possible, on the other hand, that the magical powers of the talisman were thought to be so enhanced by its being inscribed on a mirror that a functional object would be sacrificed. That the tradition of engraving circular mirrors and plaques with talismanic designs flourished for centuries in Iran may be further documented by a 19th-century plate made for a Shiʿi adherent, cat.57. No similar piece has been recorded.

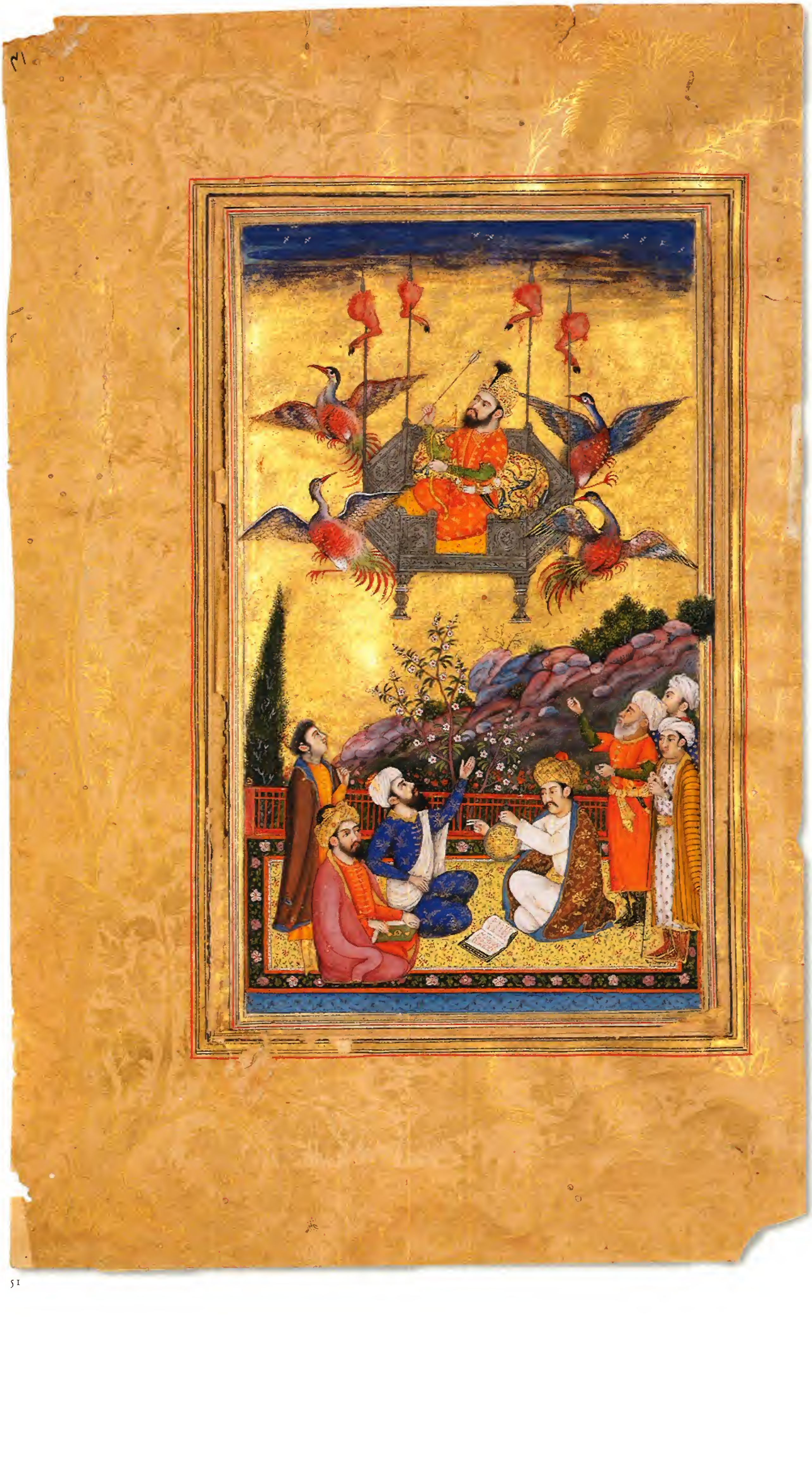
A small, circular mirror holder from late 16th- or early 17th-century Safavid Iran was evidently engraved with a talismanic design at the time of its construction (cat.53). Its pierced handle allows the mirror to be suspended as well as held in the hand, and in this case the inscription on the back can be read only when the mirror is suspended, rather than held upright by the handle as was the case with larger talismanic plaques like cat.55 and 56.

Although the artefacts themselves provide no proof, it is possible that the dark polished surfaces of the 13th-century mirrors, as well as the Safavid or Mughal examples, were used on occasion for some form of magic or divination employing reflective surfaces.[10] It is reported that in India some people pasted onto the back of a mirror a talismanic design formed of some of the *asmāʾ al-ḥusnā* combined with squares containing numerals. A child then gazed into the mirror to see forms and visions.[11] An anonymous 17th-century Arabic treatise gives a procedure for making angels appear in a mirror by writing the names of the four archangels and some Qurʾanic passages on the back of the mirror. After fasting for seven days, the person who wishes to see the vision looks into the mirror while incense is burnt and prayers recited.[12]

All of the mirrors or plaques discussed here were made in Iran or India, and all but two have prayers either for the Twelve Imams or for the five members of the holy family as recognized by the Shiʿi community. Present evidence seems to suggest that the production of such mirrrors evolved among the mystical orders of the Mongol and Timurid eras, which were characterized by the veneration of the Twelve Imams,[13] and that their production then spread throughout the Shiʿi as well as Sufi communities in both Iran and India.

51, detail

1. Soudavar (1992, pp.46–7) makes only brief mention of the talismanic inscriptions on this item which, he suggests, was made in Isfahan while Shah Shujaʿ was planning the invasion of Tabriz.
2. Inv. no.49–49, which is 18.1 centimetres in diameter, 0.2 centimetres thick. The notes on the Oxford plaque made by Professor G.L. Lewis have been of great use for this study.
3. For a general discussion of Latin squares and other types of 'magic squares', see pp.106–107.
4. For the magical use of these 'crowning words', see Canaan 1937–8, pp.94–5; Bell & Watt 1970/1977, pp.61–5; and Bellamy 1973.
5. *hawāmm* (singular *hāmmah*) means any creature that has a poisonous bite, including insects, scorpions, and reptiles; see Elgood 1962, p.153. On the other hand, William Stevenson (1920, p.100) interprets the word occurring on a talisman as *hawām* (singular *hāmah*), which are 'birds like owls in which the spirits of the dead take up their abodes. The *hāmah* of a murdered person cries out for vengeance until his death is avenged.' The word *hawāmm* or *hawām* frequently occurs on magic-medicinal bowls and amulets. The general word for troublesome insects, *ḥasharāt*, which also occurs on these plaques, is not commonly found on magic-medicinal bowls or other talismanic material.
6. For attitudes towards dementia and madness (*junūn*) in medieval Islamic society, and magical approaches to its treatment or avoidance, see Dols 1992, p.285 *et passim*.
7. Fodor 1978, especially pp.6–8. See also Doutté 1908, p.277, for the use of Hebrew names in conjurations intended to transport a person great distances.
8. For example, Victoria & Albert Museum, London, inv. no.442–1887 (see Melikian-Chirvani 1982, pp.131–2, no.59); British Museum, London, Department of Oriental Antiquities, inv. no.66 12–29 77, from the collection of the Duc de Blacas; and Museum of Turkish & Islamic Arts, Istanbul, inv. no.2972 (see Istanbul 1983, no.D.131). For illustrations of one in the Louvre and that in the British Museum, see Kalus 1991, p.104, where some similarities in the inscriptions with those on talismans useful against drought are noted. The design engraved on the one in the British Museum, however, is very similar to designs engraved on early magic-medicinal bowls which do not mention drought amongst the therapeutic applications inscribed on them. For a mirror of somewhat similar design, but with scalloped edges and an enormous 'verse square' inscribed on the flat side, see Riyadh 1985, pp.104–105, no.83. For a Chinese 'magic' mirror with an Arabic inscription on the reflecting side, dated AH 111 (AD 729–30), see Berchem 1910, pp.126–8.
9. Reinaud 1828, II, pp.404–20, pl.x. For other examples, see Allan 1976, I, pp.326–41.
10. In the art of crystal gazing, termed *ḍarb al-mandal*, the reflective surface might be water or ink as well as a mirror. See Doutté 1908, pp.387–95; Worrell 1916; and Ullmann 1992, pp.55–61. For a controversial account of divination using a mirror of ink, see Lane 1836/1908, pp.275–82; Thomas 1905, pp.104–21; and Margoliouth 1912, p.817. For theories regarding the function of Chinese 'magic' mirrors, see Turner 1966; Murray & Cahill 1987.
11. Thomas 1905, p.51.
12. Bibliothèque Nationale, Paris, MS.arabe 2705 (formerly 1203), folio 226a, discussed by Reinaud 1828, II, p.401; and Thomas 1905, pp.56–7. The procedure occurs in the second, anonymous, part of the manuscript. The first part is an autograph copy of a treatise on amulets by Ahmad al-Tanabushawi, dated AH 1045 (AD 1635–6); see de Slane 1883–95, p.489.
13. See Halm 1991, p.72.



51

King Kaykavus attempts to fly

Probably Kashmir, *circa* 1630

Miniature painting, 10.4 × 18 cm, painted in gold and colours on paper, mounted on an album page of laid paper, 18.1 × 28.6 cm, decorated in gold and wash; the painting is framed by two sets of red, black and gold lines, one on the original page and one on the mount
accession no. MSS 723

This painting illustrates an episode from Firdawsi's *Shāhnāmah* and was probably part of a copy of this work produced in Kashmir about 1630. At some stage it was mounted on an album page, with a Persian *ghazal* on the reverse.

The scene depicted is the attempt of King Kaykavus to fly, using four eagles tethered to his throne. Firdawsi's text relates how an agent of the devil wished to tempt the King into an act that would lead to his humiliation. He appealed to his vanity by challenging him to discover the secret of the motion of the Sun and Moon: 'You have acquired control of the earth, as was your ambition; now the sky should be submissive to your command.'[1] Kaykavus instructed that a group of eagles were to be fed for a year and a month on roast meat and whole lambs, until they acquired the strength of lions. Meanwhile, he had constructed a throne to which poles were attached at each corner. On the day he wished to fly, he ordered that a leg of mutton should be placed at the top of each pole and four eagles harnessed to the throne at the bottom of the poles. When the eagles became hungry they tried to fly toward the joints of meat, at the same time transporting Kaykavus up towards the clouds. The story concludes with Kaykavus's humiliation, for the birds become exhausted and plunge, with king and throne, into a forest in China.

The artist illustrating the incident has made the figures at the bottom of the painting as important to the overall composition as Kaykavus and his flying machine. Of particular interest in the present context is the man seated in the centre right of the painting, who holds a circular talismanic plaque. Talismanic symbols occasionally occur in manuscript illustrations to indicate that good fortune was being sought for the particular adventure depicted. The example shown here is notably similar to the two Safavid or Mughal talismanic mirror-plaques in the collection, cat.55 and 56. It is engraved with a grid of Hebrew letters arranged in a pattern that suggests that the artist was copying a Hebrew 4 × 4 magic square, though there was not enough room in the circular tablet for the compartments to be in their correct positions. It is also evident that the artist did not understand the Hebrew letters and formed many of them in a nonsensical manner. Similar letters appear in the open manuscript lying on the ground in front of the figure.[2] Hebrew letters were occasionally used in magical and cabbalistic talismans, and indeed al-Buni recommended writing certain names in Hebrew characters (in designs such as the rod of Moses engraved on amulets) when making a talisman for, among other things, assisting someone to fly, or to walk on water.[3]

The artist may have confused a talismanic plaque with an astrolabe, for the manner in which the man is holding the plaque and the arrangement of the surrounding scholars suggests a group of astrologers and astronomers giving guidance to Kaykavus. In the text, Kaykavus sought from astronomers advice regarding the distance between the earth and moon.[4] Nevertheless, while this particular incident in the *Shāhnāmah* is often illustrated with a group of men looking up at Kaykavus in his flying machine, the depiction of an astrologer or magician with a talismanic plaque or instrument is highly unusual, if not unique.[5]

The Khalili Collection contains another Indian copy of the *Shāhnāmah*, MSS 145, which also includes a depiction of a talismanic plaque. This occurs on folio 75a, where the birth of Rustam by Caesarean section is illustrated (see above, pp.28 and 124). The figure of a seated astrologer with a closed book before him, shown in the lower right-hand corner of the painting, holds a talismanic plaque very similar to that seen in the Kaykavus minature.

1. Firdawsi–Levy & Banani, p.59.
2. Only two of the letters can be read with certainty, *'ain* and *gimel* in the left-hand column of the top two rows. The other letters are indistinct and might be either misunderstandings of Hebrew or letters taken from the Pahlavi or Devanagari scripts. For Hebrew amulets in general, see Budge 1961, pp.212–38 and 298; Fodor 1990, pp.16–23.
3. Fodor 1978, especially pp.6–8.
4. Firdawsi–Levy & Banani, p.60.
5. This *Shāhnāmah* miniature is the only one to illustrate such an instrument: compare the three other illustrations of this event in the Khalili Collection, MSS666 (a detached miniature) and MSS466, folio 41b, both produced in Iran in the mid-16th century, and MSS544, folio 79b, painted in India and dated 27 Rabi' I 1011 (14 October 1602); and those in seven copies of the *Shānāmah* in the British Library, MSS Or.12,084, Or.12,688, Or.371, Add.27,257, Add.27,302, Add.18,188 and Add.5600; in two copies in the Bodleian Library, MSS Elliot 325 and Ouseley 369; *cf.* also Dickson & Welch 1981, II, no.95; Geneva 1985, p.60. In the British Library MS.Add.27257, folio 81a, a Safavid manuscript of the late 16th century, there are three figures in the foreground observing the event, the one on the left holding by a string handle a red pouch, perhaps of leather, which may be a container for a large talismanic chart, a collection of prayers, or a Qur'an. In all other copies examined, where there are observers they are empty handed. Similar flying devices powered by birds – enticed upwards by legs of mutton attached to the tops of tall poles – are found in medieval European illustrations of Alexander the Great's celestial journey; see Cary 1956, pp.134–5.

52

Mirror reused as a talismanic plaque

Iran or Anatolia, 13th century

Cast bronze, with black patination
diameter 11 cm *thickness of rim* 0.4 cm; reflective surface engraved at a later date
accession no. MTW 897

This undated mirror is an example of a type produced in some quantity in the late 12th or early 13th centuries, perhaps in the eastern provinces of Iran.[1] What distinguishes this example is the fact that the flat, reflecting, side was later engraved with a talismanic design. Other examples of this practice are known, though this is the most elaborate.[2]

At the centre of the talismanic design is a 4 × 4 magic square whose common sum is 34. Surrounding this square are three rings of magic letters and numerals, with a similar ring running inside the edge of the mirror. Six large circles enclose the central square; each of these contains seven lines of magic symbols, and the spaces between are filled with similar symbols. The format of circles or other clearly delineated areas filled with lines of magic writing is typical of engraved magic-medicinal bowls of the 12th and 13th centuries (compare cat.25 and 26). The nature of the magical alphabet employed on this mirror is, however, more in keeping with those found on items of the 14th or 15th century (*cf.* cat.27). In the areas above and between the circles a large and deeply incised *naskh* inscription in six parts reads, 'All your affairs/by the truth of the veneration of Muhammad/ Mustafa, by the truth of the four/[sincere] friends, 'Ali and Fatimah,/Husayn and Hasan./Abu Mihr Kassas.'

The two spaces allotted to the names of 'Ali, Fatimah, Husayn and Hasan appear to have carried an earlier inscription that was obliterated. It is possible that they originally bore the names of the four orthodox Caliphs and that the mirror was re-engraved to give it a distinctly Shi'i character.

The order of the names of the holy family is most unusual, however, for rarely is Husayn named before Hasan. The last name given in the inscription, Abu Mihr Kassas, is probably the person for whom the mirror was redesigned.

In the centre of the back of the mirror, decorated in low relief, is a pierced knob to which a cord could be attached. Around it are two addorsed, winged and human-headed lionesses, also moulded in low relief. An encircling band framed by the raised edge of the mirror encloses the design, and contains a Kufic inscription in rhymed prose invoking good fortune for its owner: 'Power and long life, good fortune and beauty, high standing and praise, happiness and high rank, authority and prosperity, to its owner forever.'

1. See Melikian-Chirvani 1982, pp.130–31, no.58, where a detailed bibliography is given for such pieces. See also those sold at Sotheby's, London, 16 April 1987, lot no.328; 25 April 1990, lot no.95; 10–11 October 1990, lot no.158.
2. For another example, see cat.79, below. A third specimen of the type in the Khalili Collection, MTW 829 (ex-catalogue), is not in good condition. For others, see above, p.125, note 8.

52, back

52, front

53

53

Mirror holder

Iran, late 16th or early 17th century

Cast brass, traces of a brown compound in the engraving
height including handle 9.4 cm
diameter 6.7 cm *thickness of rim* 0.35 cm
accession no. MTW851
published Christie's, London, 10 October 1989, lot no.433

Unlike cat.52, this holder for a mirror was probably engraved with a talismanic design at the time of its construction. It is undated, but its style of engraving and general design suggest that it is a Safavid product of the late 16th or early 17th century.

Engraved on the flat back of the mirror holder there is a 5 × 5 Latin square formed from the invocation, 'O Great One, You whose majesty the discerning are unable to discover a way to describe!' The Persian text filling the space around this square, in a compact *naskh* script, has no obvious beginning and consists of numerous prayers for protection and the annulment of spells.

A bevelled circular edge on the reverse would have held the mirror, which is now missing. The interior surface of the recessed ground is unfinished, and has not been worked after casting. A protruding loop at the top served as a handle or as a suspensory device.

54

Mirror case

Iran, perhaps late 19th century

Silver sheet, engraved, the loops and frame soldered on
8.6 × 7.6 cm (including loops)
accession no. MTW1346

This mirror case was apparently to be carried on the person as an ornament, a talisman and a looking glass. It was worn suspended by a cord passing through the two loops attached to the frame. The inscriptions on it are oriented so as to be most easily read when the mirror is held with the suspension loops at the bottom.

The back plate, the frame and the loops all bear inscriptions. Those engraved on the back and outer edge of the frame consist of Qur'anic quotations such as surah *al-Naṣr* (CX, verses 1–3) and surah *al-Tawbah* (IX, verse 129), and prayers and invocations to 'Ali. These inscriptions are framed above and below by a band engraved with a zigzag design, and the same motif – an inscription between two zigzag bands – recurs along the eight sides of the back plate, although this is now partially obscured by the frame.

The main focus of the design on the back plate is, however, the magical use of the 'crowning words' and letters occurring in the Qur'an.[1] The central medallion contains 11 compactly written lines of these words and letters, many of them repeated several times. The medallion is enclosed by three rings containing inscriptions or decoration, engraved on stippled grounds. The innermost of the three rings is filled with a tree-like decoration formed of two triangles bisected by a vertical line. The middle ring contains prayers and invocations to God, including a variation on verse 5 from the surah *al-Fātiḥah* (I). The outer ring is filled with repetitions of the word *hamm*, which, in this context, means 'the object or action that is being sought'.[2] These three concentric rings are themselves enclosed by a circular band filled with the same zigzag design as the border. The space between the border and the circular design is filled with two large inscriptions, reading 'O Sufficient in difficulties' and 'O Judge of necessities', both engraved in a large *nasta'līq* script reserved against a hatched ground. The two suspension loops are each faceted, and three faces of each are inscribed with invocations in a tiny script.

No comparable mirror has been described in the literature. The nature of the metalwork is similar to some of the Qajar silver arm amulets, such as cat.99 and 100. The arrangement of the Qur'anic 'crowning words' in the central roundel on this piece resembles that given in an Urdu treatise on talismans, *Naqsh-i Sulaymānī*, by an otherwise unknown author named Abu Sulayman Zahir al-Din Ahmad.[3] In this treatise, Abu Sulayman states that if the pattern of words and letters is engraved on silver and worn on the person, the prosperity of the bearer will increase, his enemies will be subdued and his safety from the evil eye and spells will be maintained. Furthermore, if a woman wants an abortion, she should hang about her neck a tablet of silver on which the letters have been engraved.

1. For these letters and words and their magical associations, see Canaan 1937–8, pp.94–5; Bell & Watt 1970/1977, pp.61–65; and Bellamy 1973.
2. Canaan 1937–8, p.89.
3. A revised version of this treatise was printed in Urdu at Lucknow in 1909; there is a copy in the India Office Library, London. An English translation, apparently by Khuwajah Ashraf Ali Lucknowi, occupies part 3 (pp.1–84) of Dehlvi 1993; see p.49 for this particular talisman.

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Talismanic plaque

Iran or India, 17th century

Cast bronze, polished and engraved, with traces of white filling in the engraved inscriptions
diameter 19 cm *thickness* 0.2 cm
accession no. SC116

This flat, circular plaque was apparently made for a member of the Twelver Shi'i community in Safavid Iran or Mughal India.

On one side there is a large Latin 30 × 30 square flanked by two 5 × 5 magic squares.[1] Both squares use 'crowning words', that on the left from the surah *Maryam* (XIX), that on the right from the surah *al-Shūrā* (XLII). Above and below the larger square are two true magic squares, with numerals in the cells. The 5 × 5 square at the top yields the sum of 65, the 4 × 4 square at the bottom the sum of 34.

An Arabic inscription in *naskh* runs anticlockwise around the periphery, beginning at the upper tip of one of the small magic squares, where a hole has been drilled, with a break where the handle would have been placed. It reads, 'O God, bless Muhammad the Chosen and bless, O God, me who ask Thee, by their [the Imams'] right and their holiness and their distinction and their status and their reward with Thee, avert us from the evil of every evil one and the betrayal of every perfidious man and woman / and the deception of every cunning man and woman and the machinations of every scheming man and woman. O God, I take refuge with Thee from the evil of demons (*jinn*) and humans, from the evil of every tempter, male and female, and every evil spirit, male and female. Protect us from every disease, distress, pain and illness.'

The text continues along an inner ring of inscriptions, beginning at the top right-hand corner of the large square and moving anticlockwise, with the small magic and Latin squares

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55

55

interspersed: 'and the anxiety of fears of *jinn*/and men, and from the evil of every person,/from vermin and insects, from the evil of/oppressive, reproachful and difficult people,/ [from] vainglorious men and women/ and profligate men and women,/or "from the mischief of those who practise Secret Arts; /and from the mischief of the envious one as he practises envy." ' The last two lines are from the surah *al-Falaq* (CXIII, verses 4–5).[2]

The obverse is blank except for a circular inscription – an invocation to God asking His blessing on Muhammad and the Twelve Imams – near the edge, beginning opposite a blank space with two drilled holes where the handle would have been attached. Seven other bored holes, evenly spaced around the edge of the plate, were perhaps used to mount the plate on a wall.[3]

1. For further details, see pp.106–107.
2. An almost identical plaque in the Museum of the History of Science, Oxford, lacks the quotation from the surah *al-Falaq*. See p.125, note 2.
3. Under magnification it is evident that some of the holes were drilled before the inscription was engraved. This applies to the two holes for the handle, and three small equidistant holes. The other four peripheral holes appear to have been drilled later and have the characteristic triangular shape of holes made with a bow drill.

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Talismanic plaque

Iran or India, 17th century

Silver, with traces of red compound in the engraving
diameter 22.1 cm *thickness* 0.2 cm
accession no. SCI17

This undated and unsigned talismanic plaque is a more elaborate version of the type represented by cat.55 and is probably a product of the same workshop. A handle was once attached to the base, and the inscriptions and magic designs would have been legible when the plaque was held upright, with the handle at the bottom.

On one side there is a large 30 × 30 Latin square,[1] but the surrounding small squares and circular diagrams differ from those on cat.55. A pair of small squares appears along each of the four sides of the large square. One is a 4 × 4 magic square yielding the sum of 34, identical to that on cat.55, and the other has four lines of magical writing and ciphers.

Interspersed between these four pairs of small squares are roundels containing emblematic representations of the 12 zodiacal signs, three on each side of the large square, beginning with Aries at the upper right-hand corner of the large square and proceeding anticlockwise. These representations employ commonly accepted conventions, such as a two-headed man sitting cross-legged for Gemini, a bearded man using a scythe to cut grain for Virgo, a cross-legged man with scales suspended over his head for Libra and a man drawing water from a well for Aquarius. Leo is shown as a lion surmounted by the radiant disk of the Sun, indicating that astrologers thought the Sun most frequently associated with, or domiciled in, Leo.[2] The sign of Sagittarius is depicted as half-human and half-fish, shooting an arrow at the head of a dragon which forms the end of his tail. This design was a conventional way of alluding to the lunar node often associated with that constellation.[3] Immediately above each group of three zodiacal signs and two squares there is an engraved Persian inscription, *sharaf-i āftāb / khātim-i āftāb* ('exaltation of the sun, seal of the sun'), the significance of which is not apparent.

The name of one of the four orthodox Caliphs, Abu Bakr, 'Umar, 'Uthman and 'Ali, is written near the midpoint of each side of the large square, and at each of its four corners two words are inscribed which, beginning at the upper right-hand corner and moving anticlockwise, read as an invocation: 'O God, protect the owner of this [mirror] from every affliction and infirmity.'

Around the outer edge of the plaque, beginning at the top, there is an inscription in Arabic running anticlockwise, with a break where the handle once was. It is identical to that on cat.55, except for the opening phrase, 'O God, I ask Thee, by their [the Imams'] right …'. The closing words – 'anxiety and the fear of *jinn* and men' – occur on cat.55 at the begining of the inner ring of inscriptions. On cat.56, the text continues in the inner ring, beginning at the top right-hand corner of the large square and running anticlockwise below the zodiacal signs and small magic squares: '… and from all afflictions, infirmities,/ ailments, dementia, and diseases,/and from the evil of every devil (*shayṭān*) and envious person./… that I stay close to a straight path.'

The obverse has only a circular inscription near the edge, beginning at the top, consisting of an invocation to God asking His blessing on Muhammad and the Twelve Imams.

1. This is identical to the square on cat.55. For further details, see p.124.
2. Compare the figures on the exterior of the magic-medicinal bowl, cat.29.
3. See Hartner 1938; and 1965.

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Talismanic plaque

India or Iran, 19th century

Copper or copper-alloy plate, tinned and engraved, with traces of a black filler
diameter 15.3 cm *thickness* 0.1 cm
accession no. SCI18

The plaque is blank on one side, with four punched holes, equally spaced, near the periphery, indicating that it was at one time mounted on a wall or fastened to a larger holder. The design on the front consists of 14 concentric rings around a central area containing the word *Allāh*. The three small inner rings of tiny pseudo-inscriptions are followed by one ring of numerals which consist largely of the numbers 7 and 8, surrounded in turn by a blank ring. The inscriptions in the next ring name the five members of the holy family recognized by the Shi'ah. The next three rings each have 19 cells containing *abjad* letter-numerals. The tenth and broadest ring has lunette sigla.[1] The next two rings each contain the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255), with the text inscribed the second time using a broad Kufic script. The penultimate concentric ring contains a compactly written text reading, 'God is He, than Whom there is no other god', from the surah *al-Ḥashr* (LIX, verse 22), followed by many of the *asmā' al-ḥusnā* and ending with a prayer and invocations. The inscriptions in the outermost ring, in a very broad, stylized script, are not legible.

1. For lunette sigla, see Canaan 1937–8, pp.141–3; Doutté 1908, pp.158–9, 244–8 and 288.

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Amulets and related talismanic objects

by Emilie Savage-Smith

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Pendant

17th or 18th century

Nephrite jade, point engraved and wheel cut, 8.2 × 8.7 × 0.8 cm
accession no. TLS 7

One side of the pendant has five lines of incised magical numerals, repetitions of 116, 117 and 118, with slight variations. On the other side, seven lines of *naskh* script in the centre contain the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255). This is surrounded on four sides by the Shi'i prayer for the Twelve Imams, beginning at the upper, protruding edge of the amulet. Both inscriptions are written without diacritical dots, but with some vocalization.

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Pendant

Silver, engraved, 6 × 6.5 × 0.1 cm (without loops)
accession no. TLS 15

A simple line frame encloses 10 lines of carefully inscribed magical letters, numerals and symbols. Two suspensory loops are placed close together at the top.

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Pendant

Silver, 4.4 × 3.7 × 0.1 cm (without loops)
accession no. TLS 16

In the centre of one face of the pendant there are six lines of an elaborate pseudo-Kufic design (one line upside down), and a line of similar script runs vertically down either side. A frame near the edge of the amulet uses the same pseudo-writing. There are three suspensory loops at the top. The back is blank.

The Khalili Collection has a large number of Islamic amulets and related talismanic objects which permit an appreciation of the development, continuity and change in the use of certain talismanic motifs;[1] the relatively early date of some of these items makes them of particular interest. It is not the intention of this chapter to deal at length with all the numerous varieties of amulet, but rather to illustrate briefly a few of the more common designs and then to concentrate upon four groups of amulets and related objects that are distinguished by very distinctive iconographic motifs: long-horned animals, lions with scorpions, fish and hands. Two groups of recent objects, each distinguished by a particular function – metal amulet cases and arm amulets – are discussed in conclusion.

The majority of published accounts of Islamic amulets are concerned with material produced in the 19th and 20th centuries, particularly in Egypt, Syria, Palestine and Iraq.[2] The work of Tawfiq Canaan on the decipherment of Arabic talismans, based for the most part

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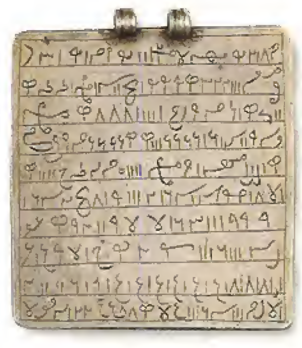

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upon his own collection of amulets acquired in Syria early in the 20th century,[3] is fundamental to any serious study of the subject. Most of the amuletic material selected from the Khalili Collection for discussion here, however, is not represented in these earlier studies.

The words 'amulet' and 'talisman' have been defined differently by various scholars. Some consider an amulet to be an object that is supposed to function continuously for as long as the object exists, while a talisman is something that is intended to be used only once and then discarded.[4] Others have defined an amulet as an engraved stone, used either as a seal or worn as amuletic jewellery, and a talisman as a metal object, either engraved with a talismanic design or formed into a talismanic shape, over which a magical ceremony is performed.[5] In the 19th century, Edward Lane gave the word *ṭilasm* the all-encompassing, but confusing, definition, 'mystical devices or characters, astrological or of some other magical kind: and a seal, an image, or some other thing, upon which such devices, or characters, are engraved or inscribed; contrived for the purpose of preserving from enchantment or from a particular accident or from a variety of evils, or to protect a treasure with which it is deposited, or (generally by its being rubbed) to procure the presence and services of a *Jinnee*.'[6]

What is evident is that the terms amulet and talisman are constantly confounded, used interchangeably or defined in arbitrary and differing ways. The applications and meanings of the numerous Arabic and Persian terms for amulets and talismans – which include *ṭilasm*, *ḥijāb*, *ḥamīlah*, *ḥirz*, *māskah*, *ta'wīdh*, *tūmār* and *bāzūband* – differed from region

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Seal matrix

Copper alloy, cast and engraved, now much corroded and damaged at the edge
approximate diameter 5 cm *thickness* 0.25 cm, with a flange 1.8 cm high on the back
accession no. MTW 320

This early seal-matrix bears nine lines of talismanic inscriptions incorporating various numerals, abbreviations for *Allāh* and the words *ṣaḥḥah* and *kāfī*, engraved within a circular frame enclosing a *naskh* inscription, of which only the repeated phrase *yā Allāh* can now be read. All of the inscriptions are written in mirror image. The flange on the back has a hole for a cord or chain.

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Pendant
Perhaps Indian

Slate, engraved and drilled
dimensions 3.7 × 3.6 × 0.5 cm
accession no. TLS 5

The front bears a 4 × 4 magic square yielding the common sum of 10587, with the numeral for seven engraved horizontally, as is customary in Indian products. The back is blank. Two small holes are drilled near the upper edge.

2646	2649	2653	2639
2652	2640	2645	2650
2641	2655	2647	2644
2648	2643	2642	2654

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Pendant

Nephrite jade, carved
2.6 cm × 3.1 (with 'handle') × 0.6 cm
accession no. TLS 49

The pendant has a hole through the 'handle' at the top to permit it to be suspended by a cord. Both sides bear rows of magical letters and numbers (five rows on one side, six on the other), framed by a rectilinear design of incised vs.

to region and were often used interchangeably, with little loss of meaning. Since the words themselves are usually not part of the magical artefacts that are preserved, the terms by which we designate them are rather arbitrary.[7]

For the purposes of this chapter, the term amulet is used for any relatively small object intended to be worn to ensure protection and well-being. Such objects are usually made of long-lasting materials and were apparently meant to function continuously over a long period.[8] In the case of the examples catalogued here, only those intended to ensure love between a couple were designed for the use of a single person (see cat.94 and 95 in Group 6, illustrated below); it would seem that in the other circumstances the beneficial powers were passed on to whomever possessed the amulet. It should be noted, however, that it is often difficult to distinguish between amulets intended to be generally efficacious and those which were believed to prevent or cure a specific condition, such as the evil eye or infertility, since the intended use is almost never specified. The term talisman has generally been employed here for the more ephemeral forms of amulet, such as those written on paper or parchment, while the adjective 'talismanic' has been used broadly to describe any object on which there is a magical design.

The use of stones and other materials as amulets was a common practice throughout the ancient Near East and in the Graeco-Roman and Byzantine worlds, and the literature on amulets in these earlier cultures is vast.[9] Comparable studies of Islamic amulets have not been undertaken. It is evident, however, that certain features of Islamic amulets distinguish them from those of earlier societies or of contemporaneous Europe. Islamic amulets very rarely invoke a demonic force, but instead address their supplications to God through Qur'anic quotations and invocations employing the Beautiful Names of God, *al-asmā' al-husnā*.[10] With the exception of some recent practices at Shi'i religious sites, there is no Islamic tradition of leaving votive amulets at a shrine to ask for health or to give thanks when health has been restored. Moreover, Islamic amulets were not employed in any magical ceremonies.[11] They are objects worn to ensure well-being and success.

Seals, or more precisely seal-matrices, can have talismanic properties as well, for they are also small objects (carved from a gem or made of metal or glass) on which a talismanic inscription has been engraved in reverse or 'mirror image'. They are not, however, true amulets as defined above, for while a seal may be worn, either suspended on a cord or set into a ring, its magical power does not take effect until its inscription has been stamped onto a surface where it can be read in the correct sequence.[12]

Also included in this chapter are household objects whose talismanic designs are closely related to those of the amulets under discussion. A ladle of high-tin bronze and two bone spoons of the 9th or 10th centuries, for example, have talismanic designs and inscriptions written in early Kufic that are strikingly similar to those on amulets of the same period; all these are illustrated in Group 1 below. A mirror included in Group 2 also demonstrates the continued use of a distinctive talismanic design on both personal and household amulets.

Magic squares, which are totally lacking from pre-Islamic amulets, are a prominent feature in the talismanic designs of Islamic amulets made from the 13th century onwards.[13] On the other hand, certain pre-Islamic motifs greatly influenced early amuletic designs in the Islamic world: these include the rampant lion, the scorpion, a long-horned, oryx-like animal, fishes and the outline of the human hand, all of which are represented in the first four groups of objects described here. The magical combination of the radiant Sun with a lion is another pre-Islamic motif evident on Sumerian, ancient Egyptian and Graeco-Egyptian artefacts, and is found on many Iranian amulets, both old and new.[14] Numerous

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examples of Islamic metalwork show a lion surmounted by the radiant disk of the Sun, following the astrological attribution of the Sun to the zodiacal house of Leo, where it was considered to be domiciled.[15] In a magical context, the combination probably lost its precise astronomical significance, other than referring obliquely to the intensity of heat at the height of the summer in northern latitudes. Magical writing composed of letters, numerals and, occasionally, lunette sigla[16] sometimes formed the entire design of an amulet. Pseudo-Kufic writing was also frequently employed for talismanic decoration.

Included among the amulets catalogued here are a number of amulet cases. Some are small boxes intended to be strapped to the arm and often containing a miniature Qur'an (*muṣḥaf*); because every Qur'anic verse is believed to possess a force that can counteract evil and disease, this would be the most desirable protection possible. Others are cylindrical tubes suspended horizontally about the neck and containing scrolls of prayers or Qur'anic quotations. The cases themselves usually have Qur'anic verses or magic squares engraved on them and, when filled with their proper talismanic contents, also functioned as an amulet providing protection to the wearer. All the examples of this type discussed below are probably from Qajar Iran or Ottoman Turkey.

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Pendant

Iran, 14th century

Copper alloy, sheet and engraved,
2.6 × 4.7 × 0.26 cm
accession no. TLS 1958

This tablet-shaped pendant is from the same workshop that produced cat.64. On one side are four lines of talismanic numerals and letters, with the word *Allāh* written at the 'handle' of the tablet. On the obverse, an inscription written in large, well-formed *thulth* reads, 'Perpetual glory and prosperity'.

65

Pendant

Iran, 14th century

Copper alloy, sheet and engraved,
2.5 × 4.4 × 0.3 cm
accession no. TLS 1959

This tablet-shaped pendant has the suspensory eye set at right angles to the 'handle' of the tablet. On one side there is a lion, with the face of a rising sun beyond, and on the reverse a Kufic inscription.

1. Only a selection of the amulets in the Collection are catalogued in this volume. For additional amuletic jewellery, see Wenzel 1993.
2. Hildburgh 1906; Walker 1934; Donaldson 1938; Budge 1961; Kriss & Kriss-Heinrich 1962; Bachinger & Schienerl 1984; Fodor 1990; Shinar 1991; Schienerl 1988; and an uncritical assemblage of contemporary Iranian material in Gluck & Gluck 1977.
3. Canaan 1937–8. His collection of amulets is now at the Pitt Rivers Museum, University of Oxford, where it forms part of the Wellcome Collection of Amulets on long-term loan to the museum.
4. For example, Budge 1961, p.14.
5. Pingree 1987a, p.58.
6. Lane 1863, part 5, p.1867.
7. The term *aḥrāz* occurs on the talismanic scrolls contained in the Qajar cylindrical amulet case cat.88 (in Group 5).
8. A talismanic shirt does not qualify as an amulet, by virtue of its size.
9. For example, see Bonner, 1950; Delatte & Derchain 1964; Vikan 1984; Kotansky 1991; Spier 1993; and Andrews 1994.
10. The invocation of demonic forces recommended in magical manuals is not reflected in the preserved amulets made of permanent materials, though an occasional ephemeral talisman of paper or parchment might employ them; see Canaan 1937–8, pp.84–6; and Rehatsek 1874b, pp.312–13. Even in the popular 'Charm of the Seven Sleepers' it is God who is primarily invoked, and the 'sleepers' are merely intercessors; see Stevenson 1920; Anawati 1972, pp.288–95. On the other hand, many paper or parchment talismans, such as those carried in the amulet cases shown in Group 5, are either prayers to God or extensive quotations from the Qur'an, and sometimes even an entire Qur'an in miniature.
11. Amulets employed today in *zār* ceremonies in Egypt and the Sudan must be considered in a different catagory; for the *zār* cult, see Boddy 1989; and for *zār* amulets, see Kriss & Kriss-Heinrich 1962, figs 115–117; Bachinger & Schienerl 1984, p.86.
12. For the extensive collection of seals in the Khalili Collection, many of which are talismanic, see Kalus, forthcoming.
13. For the various types of magic squares, see the essays on talismanic charts above, pp.106–107.
14. For material from the ancient Near East, see Vollgraff-Roes 1953; for ancient Iranian parallels, see Fodor 1987–8, p.262; for Sekhmet, and other female dieties depicted with these attributes, see Andrews 1994, p.34; see also Bonner 1950, figs 211, 226 and 255.
15. For examples in the Khalili Collection showing the Sun domiciled in Leo, see cat.29 and 56. See also Hartner 1938.
16. For these distinctive magical symbols, see Canaan 1937–8, pp.143; Doutté 1908, pp.158–9, 244–8 and 288.

Group I: amulets and related objects with long-horned animal motifs

Certain Iranian amulets and other amuletic objects of about the 9th century, all of which bear Qur'anic verses or pious phrases written in an early form of Kufic, are also engraved with the representation of an animal with very long horns extending over its back, resembling an oryx. The amulets in the Khalili Collection that fall within this group display the motif in various permutations.

On the engraved limestone amulet cat.66 only the head of the long-horned animal is depicted in conjunction with a scorpion. An amulet of jet, cat.67, shows the whole animal and a second creature of such indistinct form that it cannot be identified. Both the horned animal – as a full figure – and the scorpion are combined with a bird on a bone spoon, cat.68, while a stag's head and a bird are found together on a smaller spoon, perhaps of ivory, cat.69: the inscriptions on this are particularly difficult to read but include invocations to the five members of the holy family especially revered by the Shi'i community, Muhammad, Fatimah, Ali, Hasan and Husayn. Two cylindrical bone amulets (cat.70 and 71) show identical long-horned animals, each surrounded by Qur'anic verses. The latter is also inscribed with the same Qur'anic passage as that found on a curved amulet of tusk (cat.72), and in an identical Kufic script with the same epigraphic peculiarities.

Closely related to these amulets in terms of their overall design and the early Kufic script of the inscriptions are three objects of uncertain function, all of bone or tusk, cat.73–75.[1] Similar inscriptions and a full view of a stag, as well as an unidentified animal, can be seen on a 9th- or early 10th-century ladle of high-tin bronze from Iran.[2]

On all these amulets and related items, the early form of Kufic script argues for a very early, possibly 9th-century, date. It is likely that the association of magical properties with the long-horned animal depicted on the objects derives from pre-Islamic traditions.

1. Cat.73 is also related to TLS2612 (ex-catalogue), though the latter lacks the animal forms. Five other items in the Collection are closely related to cat.74 but are not illustrated here (TLS 2617 through TLS 2621, all ex-catalogue).
2. A second high-tin bronze ladle in the Collection, TLS 814 (ex-catalogue), is also engraved with a similar four-legged horned animal and Kufic inscriptions. For a white, or high-tin, bronze ladle of 9th- or 10th-century Iran that is somewhat similar but lacks the animals and talismanic inscriptions, see Melikian-Chirvani 1974, p.139, fig.24. For another with a Kufic talismanic inscription attributed to 9th- or 10th-century Egypt, see Fehérvári 1976, pp.46, 47, no.23, where other comparable material is cited.

66
Amulet
Perhaps Iran, 9th century

Limestone, 4.9 × 4.6 × 0.6 cm
accession no. TLS 1956

The calligraphy employed on this roughly circular limestone amulet is typical of early Islamic scripts of the 9th century, as seen, for example, in the form of the final *mīm* with its short extension to the left. The suspensory eye is set parallel to the face of the amulet. On one side the text of the surah *al-Ikhlāṣ* (CXII) is engraved around a schematically rendered scorpion; the last line of the surah is repeated at the bottom, for the form of the scorpion interferes with some of the words on the row above. The head of an animal with very long horns, resembling an oryx, is engraved on the obverse and around it is written the text of the *al-Falaq* surah (CXIII).

67
Amulet

Jet, carved; pearl and gold pendants and chain are later additions
6.7 × 2.2 × 1.8 cm
accession no. TLS 1920

This octagonally faceted amulet has tapered ends. On one of the two wider flat faces there is a long-legged quadruped animal with very long horns, resembling an oryx. Words are written in Kufic script on three sides around this animal, while to either side a decorative design of six cells is formed from an ornamental Kufic. On the other large face two lines of Kufic script surround the image of another animal, possibly a scorpion, whose form is indistinct. Four of the other elongated faces bear a line of Kufic script. The remaining two are blank except for bored holes through which the chain and the pendants are attached. The faces of the tapered ends are incised with triangular designs.

68
Spoon

Bone, carved
length 13.1 cm
maximum width 3.2 cm
accession no. TLS 2610

The spoon handle is carved with a bird in silhouette at the top. In the bowl of the spoon there is the figure of a four-legged horned animal encircled by an inscription which contains the *shahādah* or affirmation of faith, 'In the name of God, the Merciful, the Compassionate, there is no god but God, Muhammad is the messenger of God.' On the back of the spoon the image of a scorpion is surrounded by the phrase 'For God over everything is all-powerful' and Qur'anic quotations from the surahs *Yūsuf* (XII, verse 21), 'God hath full power and control of His affairs', *al-Baqarah* (II, verse 153) and *al-Anfāl* (VIII, verse 46), 'For God is with those who patiently preserve'.

69
Spoon

Bone or ivory, with a gold band
length 8.7 cm *maximum width* 1.9 cm
accession no. TLS 2622

On one side of the rounded end of the spoon's handle there is a stag's head surrounded by the Kufic inscription 'In the name of God, the Merciful, the Compassionate'. On the other side the figure of a small bird is surrounded by an inscription that reads, 'I submit to God and I submit to the messenger of God.' The central part of the handle is inscribed with the invocations 'O God! O Muhammad! O 'Ali! O Hasan! O Husayn! O Fatimah the radiant one!' The invocation *yā Allāh* is also engraved beneath the gold band. The inscriptions on the outside of the bowl of the spoon are very difficult to read, though the phrase *yā ḥāfiẓ* can be discerned. On the inside there are quotations from the surahs *al-Baqarah* (II, verse 153) and *al-Anfāl* (VIII, verse 46), 'For God is with those who patiently preserve'.

70
Amulet

Bone
length 7.5 cm
diameter from 1.4 to 0.9 cm
accession no. TLS 2615

This hollow amulet bears five lines of text from the surah *al-Kāfirūn* (CIX, verses 1–6). Some textual and orthographic peculiarities occur in this Qur'anic passage, which is written in an early form of Kufic and has no diacritical dots. At the end of the fifth line of text are depicted two quadrupeds with very long horns extending over their backs.

71
Amulet

Bone
length 7.8 cm *thickness* 1.1 cm
accession no. TLS 2614

This solid, four-sided bone amulet has six lines of text from the surahs *al-Ikhlāṣ* (CXII, verses 1–4) and *al-Fātiḥah* (I, verses 2–7). As in the case of cat. 70, there are textual and orthographic peculiarities in the Qur'anic passage, which is written in an early form of Kufic, without diacritical dots. On either side of the final line there are the heads of two long-horned animals. A short indentation has been drilled into one end of the amulet while the other end is rounded.

72
Amuletic object

Tusk
9.4 × 1.6 × 0.9 cm
accession no. TLS 2466

This amulet bears six lines of Kufic script with text from the surah *al-Fātiḥah* (I, verses 1–7), followed by the phrase 'With God the Compassionate I take refuge from scoundrels.' There are textual and orthgraphic peculiarities in the Qur'anic passage, which is written in an early form of Kufic, without diacritical dots. A hole has been bored in the amulet for the attachment of a chain.

73
Amuletic object

Tusk
diameter 5.5 cm *thickness* 0.4 cm
accession no. TLS 2611

The irregularly formed, disc-shaped piece of tusk has hole bored through the centre. On the convex side, the text of the surah *al-Fātiḥah* is written in 21 lines of Kufic script radiating out from the centre like the spokes of a wheel. On the concave side, two heads of animals are incised near the central hole with the word *Allāh* written above them and the text of the surah *al-Ikhlāṣ* (CXII) encircling them.

74
Amuletic object

Bone
diameter 3.2 cm *thickness* 0.6 cm
accession no. TLS 2616

This circular object is flat on one side and curved on the other, and has a hole drilled through the centre. Near the middle of the flat side there is the figure of a four-legged horned animal with the phrase 'For God over everything is all-powerful' written above it. The central design is enclosed by two concentric rings with text from the surah *al-Ikhlāṣ* (CXII, verses 1–4) inscribed around the edge.

The curved side shows the head of a stag, with branching antlers, surrounded by the phrase 'O Judge of Necessities, God, Muhammad'. The ring of text surrounding this design contains two lines from the surah *al-Anbiyā'* (XXI, verse 87), 'There is no god but Thou. Glory to Thee. I was indeed wrong!' The purpose of the object is uncertain, though it might have served as a spindle whorl.

75
Amuletic object

Bone
length 4.1 cm *diameter* 2.9 to 3.8 cm
accession no. TLS 2613

The cylindrical object is hollow, with polished edges; the lower edge is incised with four concentric rings. The *shahādah* is engraved around the top edge, beginning at the vertical indentation that runs the length of the object. Four more concentric rings separate this inscription from two lines of text giving an abbreviated form of the surah *al-Fīl* (CV, verses 1–4). Between a ring of circles with central dots and the rings inscribed at the bottom edge, the head of a stag and the small profile of a horned animal are surrounded by text from the surah *al-Fātiḥah* (I, verses 2–5).

76
Ladle
Iran, 9th–10th century

High-tin bronze
length 42.6 cm
diameter of bowl 11.1 cm
accession no. MTW 815

At the top of the handle of the ladle, the invocation *yā Allāh* is engraved over the figure of a stag looking backwards. On the upper part of the thin handle there is a Kufic inscription of 13 short lines, beginning, 'In the name of God, the Merciful, the Compassionate, I trust in God and his sovereignty and His revealed scriptures and the Surahs of the Qur'an and for constant guidance and good fortune from God ….' Beneath the inscription there is the image of the front half of an animal. Text from the surah *al-Ikhlāṣ* (CXII, verses 1–4) is written alongside a row of dotted circles running lenthwise down the lower portion of the handle. On the other side of this row is inscribed the text of the surah *al-Kawthar* (CVIII). Clusters of circles with central dots decorate the bottom of the handle and the inside of the bowl.

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Group 2: amulets and related objects with lion and scorpion motifs

Some early Islamic amulets display a distinctive talismanic design consisting of a rampant lion facing a scorpion under a canopy of three stars each formed by two overlaid triangles,[1] the entire composition surrounded by

77

square frames of pseudo-writing representing part of the *shahādah*, the declaration of faith. The significance of the two animals, perhaps intended to represent the zodiacal signs of Leo and Scorpio, is unknown. Leo was usually associated with the hottest portion of the sun's path, and in Bedouin tradition the constellation of a lion covered a larger area of the sky than the Western constellation of Leo. In ancient Mesopotamia a constellation representing a large scorpion, covering the area now designated as Libra and Scorpio, was apparently associated with the coming of darkness as the year approaches the winter solstice, and is one of the most frequently depicted zodiacal signs on extant Babylonian remains.[2] It is likely that part of the magical power of amulets with such designs was derived from these pre-Islamic astronomical associations.

Cat.77 in the Khalili Collection is a rare example of a 10th-century Iranian amulet, probably from Nishapur. It is made of base metal, with a bird and leafy branch on one side and on the other an engraved design consisting of the rampant lion facing a scorpion and three six-pointed stars overhead. The entire composition is framed by talismanic writing simulating the repeated Arabic phrase 'There is no god but God.' The same distinctive design, though not as carefully executed, is seen on another 10th- or 11th-century Iranian amulet in the Collection, cat.78, which closely resembles two pendants found at Nishapur and now in New York.[3] The design continued to be employed virtually unchanged, but more crudely executed, during subsequent centuries.

A small mirror (cat.79), possibly of the 12th century, has the same design engraved upon the reflecting surface, but reversed right to left – that is, a mirror image that, when reflected in the reflecting surface, would be the right way round.[4]

1. A related amulet in the Metropolitan Museum of Art has three 'crossed compasses' formed by two overlaid vs instead of six-pointed stars formed by two overlaid triangles (Jenkins & Keene 1983, p.25; Allan 1982, p.70, no.61).
2. See Gundel & Böker, cols 522–8 and 696.
3. A small silver pendant 1.9 centimetres in diameter and 0.8 centimetres thick, and a cast bronze pendant 2.38 centimetres in diameter: New York, Metropolitan Museum of Art, inv. nos 40.170.246 and 40.170.245 (Jenkins & Keene [1983], p.25, nos 7b, a; Allan 1982, pp.68–70, nos 60, 61).
4. On a mirror now in the British Museum, London, the lion, scorpion, three stars and surrounding frame of talismanic inscriptions have been carelessly engraved in the same 'mirror image' manner, but a circular face of the Sun has been added to the composition, along with a cursive talismanic inscription that is written the right way round (Kalus 1991, p.104, figs 7a, 7b). A similar rectilinear talismanic design, crudely executed and the right way around, is inscribed with other talismanic designs on the reflective surface of another 13th-century mirror in the Victoria & Albert Museum, London, inv. no.442-1887 (Melikian-Chirvani 1982, p.131, no.59). On a third mirror, in Istanbul, the rectilinear talismanic frame is engraved with other magical designs, but the figures of the lion and scorpion are replaced with pseudo-writing (Istanbul 1983, pp.72, 73, no.D.131; Erginsoy 1978, p.352, fig.187).

79

80

77

Pendant

Iran, probably Nishapur, 10th century

Base metal, carved and moulded
diameter 2.6 cm *thickness* 0.8 cm
accession no. TLS 2609
published Sotheby's, London, 10–11 October 1990, lot no.391.

On one side of this carved circular pendant there is a moulded decoration consisting of a bird sitting under the branch of a tree and looking backwards. The flat side is engraved with a rampant lion confronting a scorpion, with three stars overhead, framed by rows of talismanic writing simulating the repeated Arabic phrase 'There is no god but God'.

The suspensory loop at right angles to the pendant has been broken off.

78

Pendant

Iran, probably Nishapur, 10th–11th century

Copper alloy, cast and engraved
diameter 2.7 cm (3.4 cm including suspension ring) *thickness* 0.2 cm
accession no. TLS 4

The circular pendant bears a design of a lion, scorpion, three stars and talismanic inscription very similar to that on cat.77, but more crudely executed, and the reverse side has seven rows of the same repetitive talismanic formula. The suspensory eye is set at right angles to the pendant.

For comparative items, see the essay on this page, note 3.

79

Mirror

Iran, perhaps 12th century

Copper alloy, cast and engraved
diameter 4.2 cm *thickness* 0.6 cm
accession no. TLS 2624

This small mirror has a talismanic design engraved on the reflective side that is identical to the design on the earlier pendants, cat.77 and 78, but reversed right-to-left to form a 'mirror image'. The engraving may have been added later than the manufacture of the mirror. The back of the mirror has a moulded design of an undulating flowering vine encircling a pierced knob at the centre through which a cord or chain could be passed.

78

80

Pendant

Perhaps Iran, 13th century

Silver, engraved
4.5 × 2.8 (without loop) × 0.3 cm
accession no. TLS 1957

The nature of the engraving technique used on this rectangular pendant suggests that it is a 13th-century product. The talismanic motif of lion, scorpion, three stars and rectilinear frame of talismanic renderings of the *shahādah* is identical to that found on the earlier Iranian pendants cat.77 and 78. On the reverse, three frames of repetitive talismanic inscriptions enclose the text of the surah *al-Ikhlāṣ* (CXII).

The suspensory loop is set at right angles to the pendant and off-centre.

81

Amuletic object

Copper alloy, engraved
2.9 × 2.1 × 0.2 cm
accession no. TLS 3

This square amuletic object has a schematically rendered version of the lion, scorpion and star design, and rectilinear writing. The reverse is blank.

81

Group 3: fish-shaped amulets

Three amulets in the Khalili Collection represent a distinctive type of copper-alloy amulet of fairly recent production. These flat, cast and engraved, fish-shaped pendants seem to have been made no earlier than the 19th century, and most are associated with Iran or Turkey. Each has a large hole bored through the head for a cord. The smaller versions, represented by cat.84, have diagonal rows of magical numbers. The larger forms, such as cat.82 and 83, have a 4 × 4 magic square engraved on one side, surrounded by magical numerals and non-Qur'anic magical inscriptions which also cover the other side. On the Khalili amulets, and on most of the other published examples, the inscriptions seem carelessly inscribed and have often become badly worn and illegible with time.[1]

Fish occur on other Islamic amulets of different designs and periods, including the Qajar arm amulet, cat.96.[2] They probably served as symbols of fertility and prosperity.[3]

1. For an amulet about the size of cat.82, with text apparently a mixture of Arabic, Persian and Turkish, see Kriss & Kriss-Heinrich 1962, pp.31, 32 and pl.26. Four examples of varying sizes are illustrated in Gluck & Gluck 1977, p.140; the smallest appears to be identical to cat.84.
2. For modern Egyptian amulets employing fish designs, see Kriss & Kriss-Heinrich 1962, pp.30–32. For a fish on a Qajar silver arm amulet, see Fodor 1987–8, p.276, fig.6.
3. For the talismanic interpretation of fish, see Fodor 1987–8, p.271 and especially n.81, where references to other sources are given.

82–84

Three fish-shaped amulets

Perhaps Iran, 19th century

Copper alloy, cast and engraved, 6.6 × 2.3 × 0.2 cm
accession no. TLS 11

Copper alloy, cast and engraved, 5.9 × 2.2 × 0.2 cm
accession no. TLS 10

Copper alloy, cast and engraved, 3.1 × 1.3 × 0.1 cm
accession no. TLS 9

Cat.82 is a flat pendant cast into the outline of a fish, which is accentuated by engraved edging and fins. There is a large, bored hole through the head. On one side, across the upper body, there is a 4 × 4 magic square whose common sum is 227,438 (if the numeral in the upper left corner is corrected from 56855 to 56859). The face and lower body are inscribed with non-Qur'anic magical inscriptions incorporating numerals and a six-pointed star. On the reverse, the compact inscriptions covering the face and body are so worn that they are nearly illegible. Magical numerals are engraved along the narrow sides of the pendant.

Although very badly worn, cat.83 is evidently very similar to cat.82. The ouline of the fish is emphasized by both a single thin line and a line of dots. On one side there are traces of a 4 × 4 magic square and rows of magical numerals. On the reverse, the head is marked with semicircles indicating gills or 'ears', while the body bears horizontal rows of undecipherable magical inscriptions.

The outline, fins, tail and 'collar' round the neck of the fish on cat.84, a much smaller amulet, are crudely delineated. There are diagonal rows of magical numerals on the body.

56855[9]	56862	56865	56852
56864	56853	56858	56863
56854	56867	56860	56857
56861	56856	56855	56866

84

83

82

Group 4: amuletic objects with hand motifs

The outline of the human hand with fingers and thumb outstretched is an ancient and ubiquitous talismanic design.[1] The symbol of the hand is often referred to as the 'Hand of Fatimah' and the fingers and thumb symbolize the five members of the holy family especially revered by the Shi'i community, Muhammad, Fatimah, 'Ali, Hasan and Husayn.[2] In the Islamic world the symbol of the hand was most often seen as offering protection against the evil eye, in addition to imparting general well-being to its owner.

The design is illustrated by three objects in the Khalili Collection of quite different types: a personal amulet of stone, a large metal stamp with which a talismanic design could be printed and a chart from a book of prayers. All three examples are from the 17th to 19th centuries and were probably produced for members of the Shi'i community.

1. See Doutté 1908, pp.326–9; Budge 1961, pp.467–71; Kriss & Kriss-Heinrich 1962, pp.2–7, pls 1–12; Shinar 1991, pp.133, 139; Andrews 1994, p.70; Gonen 1994; Bakker 1996, pp.50–53.
2. Schimmel 1993a, pp.115–16.

85

Amulet

Perhaps India, 18th or 19th century

Sard, point-engraved and wheel-cut, 5.1 × 7.8 × 0.9 cm
accession no. TLS 1860

On one side of the amulet there is a central design showing a hand with the three names *Allāh*, *Muḥammad* and *'Alī* written on it. Two quadrupeds with lion-like bodies and double tails stand on either side of the hand; their heads are indistinct, but the word *Allāh* is inscribed on that of the animal on the right and *Muḥammad* on that of the animal on the left. The phrase 'There is no god but God, the King, the Truth, the Manifest One' is written on the right-hand animal's body and the complete text of the *shahādah* on the left-hand animal. Surrounding this central design there is a narrow, heart-shaped band containing the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255). Near the rim of the amulet a broader band contains the text of the surah *al-Kāfirūn* (CIX) followed by that of the surah *al-Ikhlāṣ* (CXII) and ending with the surah *al-Fātiḥah* (CXIII). Between these two bands of Qur'anic verses there is a ring of 16 cartouches containing inscriptions. Reading anticlockwise from the top and largest cartouche, this text is as follows: (1) the *basmalah*; (2) 'O Muhammad!'; (3) 'Help from God and a speedy victory', surah *al-Ṣaff* (LXI, verse 13, line 2); (4) 'O 'Ali!'; (5) 'the One near to God'; (6) 'O Forgiving One!'; (7) 'authority belongs to God'; (8) 'O Guardian!'; (9) 'O God!'; (10) 'O Opener!'; (11) 'Muhammad the Prophet of God'; (12) 'the Eternal One'; (13) 'O the Merciful! O the Compassionate!'; (14) 'God is Most Great'; (15) 'the one committing himself to God'; (16) 'O 'Ali!' The numeral 5178 or 178 is written in many of the cartouches, and 5178 also occurs once in the band of Qur'anic passages near the edge of the amulet; the significance of these numerals is unknown.

On the other side of the amulet there is a 4 × 4 magic square whose common sum is 1296. Written around the sides of the square is text from the surah *al-Mu'min* (XL, verse 16, lines 3–4): 'Whose will be the Dominion that Day? That of God, the One, the Irresistible.'

323	327	330	316
329	317	322	328
318	332	325	321
326	320	319	331

86

Stamp

Dated AH 1154 (AD 1741–2)

Copper alloy, engraved, 6.6 × 9.3 cm
accession no. TLS 2707

This large stamp is shaped in the form of a hand and bears text engraved in mirror image. The index finger bears the text of the *shahādah*; text from the surah *al-Ṣaff* (LXI, verse 13) – 'Help from God and a speedy victory: so give the glad tidings to the believers' – begins on the thumb and continues on the middle finger. The remaining fingers carry invocations: 'O Muhammad! the first, the last, the apparent, the hidden. O Living One! O Eternal One! O Possessor of Majesty and Honour!' The five lines across the palm of the hand give the Shi'i formula 'There is no hero except 'Ali and there is no sword except Dhu'l-Faqar', followed by more invocations: 'O Glorious, O Compassionate One!' (lines 1–2); 'O Benefactor! O Holy One! O most Gracious! O Most Merciful! O my God Most Holy!' (line 3); 'in God is my trust ... whatever God intends' (line 4); 'He is the Lord of the throne (of glory) supreme' from the surah *al-Tawbah* (IX, verse 129) (line 5). The stamp is dated AH 1154 (AD 1741–2) beneath the final line of inscription.

A metal flange by which to hold the stamp when in use is soldered onto the back.

87

Talismanic chart

India, late 17th–18th century

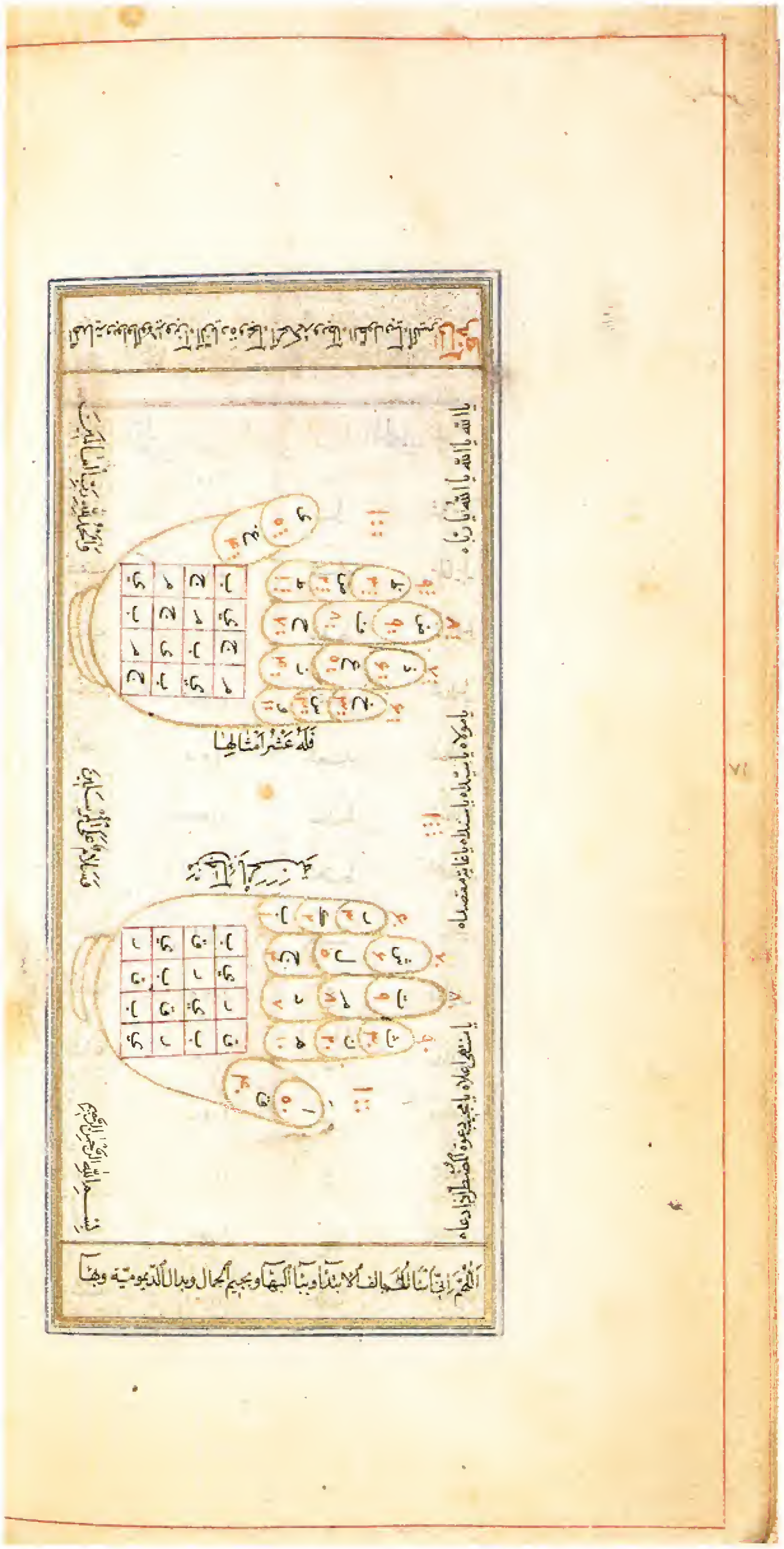
One of 167 folios, 24 × 12 cm, of a cream, burnished laid paper with no visible chain lines; written surface 15 × 6.1 cm, framed by blue, black and gold rules and containing diagrams executed in gold, black, red and orange inks, with additional text in *naskh* script in black and orange; text around the edges sprinkled with gold
accession no. MSS 970, folio 17b

This talismanic chart is from an undated collection of Arabic and Persian Shi'i prayers (*da'awāt*) compiled by 'Ala al-Din Muhammad ibn Muhammad al-Hafiz al-Tabrizi. Two hands, drawn palm side up, form the central focus of the design. On each hand there is a Latin square,[1] one formed from the word *mujīb* ('He who answers prayers') and the other from the word *qarīb* ('He who is near'). The three sections of each finger and the two sections of both thumbs are numbered with *abjad* letter-numerals in black ink, in a sequence that runs back and forth across the two hands, using all 28 letters. In addition, each of the joints between the sections of the fingers and thumbs and each of the fingertips is numbered with standard numerals in orange. This sequence begins with the little finger of the right hand and runs up the joints of each finger in turn and then along the tips. It ends with the numeral 9,000 on the tip of the index finger of the left hand, where the zeros are written as a column of three dots. The numeral 10,000 is written above each thumb, and 1,000,000 between the hands, with the zeros written in two columns. The two lines of text between the hands read, 'Whoever brings alms, to him will be ten times as much.' Prayers and invocations frame the design. The same unusual convention of representing zeros in numerals over 90 by dots written vertically can be seen on cat.30, a Safavid magic-medicinal bowl made in 1634–5, also for the Shi'i community.

1. For Latin squares, see p.107, above.

85

86



87

Group 5: amulet cases

The Islamic amulet cases in the Khalili Collection are of two basic types: cylindrical tubes to be suspended from a cord around the neck; and small boxes with two brackets or lugs for attaching a cord by which they can be bound to the arm. The latter are a form of arm amulet that will be discussed as Group 6, below.

Cylindrical tubes for preserving talismans have a long history. Pre-Islamic antecedents include ancient Egyptian and Carthaginian cylindrical containers, which were carried vertically, and Roman and Byzantine amulet cases of the same shape, which were suspended horizontally.[1]

No systematic study of Islamic cylindrical amulet cases has been undertaken, nor a typology of forms developed.[2] The earliest published example is an unfaceted case from Nishapur that is of silver, partially gilded, with relief decoration consisting of a Kufic inscription giving the text of the surah *al-Ikhlāṣ* (CXII).[3] Several specimens from Iran attributed to the 11th to 13th centuries have been published, all of them of silver with elaborate decorative motifs in niello and gilding.[4] When compared with the more recent types in the Khalili Collection they are remarkable in that they lack any Qur'anic passages. One published example from Khurasan or Afghanistan of about the 12th century is a six-faceted silver cylinder with niello designs of birds, running dogs and hares, again without Qur'anic texts.[5] Five late 19th- or early 20th-century unfaceted examples from the Yemen are recorded, all with applied granulated filigree or strips of twisted wires: these too have no Qur'anic texts.[6]

All the examples in the Khalili Collection are faceted except for cat.93, a very large case possibly from Ottoman Turkey. This piece and an unusually small example, cat.92, also lack prayers or Qur'anic verses. All the others in the Collection, probably from Qajar Iran, have inscriptions on some of the faces. The prayers on cat.89 are identical to those on a pair of lozenge-shaped arm amulets in the Khalili Collection,[7] and cat.90 may be from the same workshop, though it bears a different text and is slightly curved. In Qajar Iran, these cylindrical cases were occasionally threaded together in pairs.[8] The cords are all missing from the Khalili examples, and it is not clear if some were intended to be worn as a set in this manner.

All Islamic cylindrical amulet cases were intended to hold either scrolls of prayers or Qur'anic verses, sometimes enhanced with talismanic inscriptions. Parchment was often used for the scrolls, although it has been claimed that the skin of an unborn animal was preferred.[9] All the cases catalogued here were empty on entering the Khalili Collection, except for two which contained tightly rolled scrolls inscribed with prayers. One of these, cat.88, is illustrated here.[10] Nine other cases in the collection were made for Shi'is, for on these cases the names of 'Ali and Muhammad are given alternately at the end of the cartouches containing Qur'anic verses, in which the surahs *al-Fātiḥah* and *al-Nās* (CXIII and CXIV) predominate. They are represented in this catalogue by cat.91.[11]

Other Qajar examples have been illustrated in sale or exhibition catalogues, and a bejewelled example with no Qur'anic verses has been published.[12] Modern cylindrical amulet cases from Sarajevo and Mostar, as well as those used today in Cairo in *zār* ceremonies, have also been published.[13]

1. See Schienerl 1988, pp.11–30.
2. James Allan (1976, II, pp.569–71) began a preliminary classification of several artefacts based on the form.
3. Allan 1982, pp.60–61, no.1.
4. Hasson 1987a, pp.23, 40, 41.
5. Stuttgart, Linden-Museum; Kalter 1987, fig.61.
6. Hasson 1987b, pp.90–91, nos 122–125; Fodor 1990, no.116.
7. TLS 1A and TLS 1B (ex-catalogue).
8. Two sets of amulet cases strung in this manner, from a private collection in Switzerland, are illustrated in Hasson 1987b, p.36, no.44.
9. Budge 1961, p.34, pl.1,1.
10. TLS 28B, ex-catalogue, is inscribed with text from the surah *al-Kāfirūn* (CIX, verse 1–3).
11. TLS 37–44 are closely related. Two bear the text of the surah *al-Kāfirūn* (CIX), while the other six have either surah *al-Fātiḥah* (CXIII) or Surah *al-Nās* (CXIV).
12. For this example, now in a private collection in New York, see Hasson 1987b, p.36, no.43. For other Qajar cylindrical cases, see Fodor 1990, nos 113–14; three examples sold at Sotheby's, London, 12 October 1988, lot no.182; 14 examples, many of them with Shi'i inscriptions, sold at Sotheby's, London, 28 April 1994, lot no.161; and one case attributed to the 17th century, sold at Christie's, London, 26–28 April 1994, lot no.340.
13. For examples from Sarajevo and Mostar, see Kriss & Kriss-Heinrich 1962, figs 56.2 and 99; Fodor 1990, no.112. For *zār* amulet cases, see Bachinger & Schienerl 1984, p.73; for the *zār* cult, see Boddy 1989.

88

Amulet case
Probably Iran, 19th century

Perhaps silver, with enamelled areas and a ground darkened with a black compound
length 7.8 cm *diameter* 1.4 cm
accession no. TLS 28A

The case is inscribed with the text of the surah *al-Nās* (CXIV). It contained a talismanic scroll of parchment with prayers written in gold, red and black inks. An inscription on this scroll stated that the talisman (*aḥrāz*) was dedicated to the Imams, suggesting that it was written for a Shi'i or Sufi adherent.

The ground of the case has been darkened with a black compound and there are triangular areas enamelled in green. The side with the suspension loops is decorated with a flower-and-leaf design.

89

Amulet case
Probably Iran, 19th century
Silver, gilded
length 8.8 cm *diameter* 1.7 cm
accession no. TLS 32

The six facets of the case are inscribed with the following prayer: 'In the name of God the Merciful and Compassionate / O Renowned in the skies, O Renowned on / the ground, O Renowned in this world and in the next / even though tyrants and rulers work hard for the suppression of Your light / and the extinction of Your word, so let it be, nevertheless, that Your light will persist / and Your word be disclosed, "even though the pagans may detest it" surah *al-Tawbah* (IX, verse 33, line 4).'

90

Amulet case
Probably Iran, 19th century

Silver, gilded
length 9 cm *diameter* 1.5 cm
accession no. TLS 29

This case is from same workshop as cat.89, though not as carefully executed, and it is unusual in being slightly curved. Although similar in overall design to the other case, the inscriptions differ, for text from the surah *al-Qalam* (LXVIII, verse 51, line 4, and verse 52) occupies two faces. The other four faces are decorated with flowers, the flowerheads in gilt, and large gilt flowers separate the cartouches on each face.

91

Amulet case
Probably Iran, 19th century

Silver, engraved
length 7.9 cm *diameter* 1.5 cm
accession no. TLS 33

The long cartouches on the sides of the case contain the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255, lines 1–6), with the *lām-alif* written with a knot design. At either end of the cartouches the name of Muhammad alternates with that of 'Ali. The side with the suspensions loops is simply hatched.

92

Amulet case
Probably Iran, 19th century

Silver, engraved
length 6.4 cm *diameter* 1.4 cm
accession no. TLS 30

This unusually small case is decorated only with flowerheads, and has no inscriptions.

93

Amulet case
Perhaps Ottoman Turkey, 19th century

Silver, engraved; areas inlaid with a black compound
length 9.5 cm *diameter* 1.8 cm
accession no. TLS 31

This amulet case is larger than usual and has three suspension loops. A further six loops on the opposite side were intended for the attachment of ornamental pendants. The case is not faceted and has no inscriptions. It may be an Ottoman product.

88 with scroll (top); 89, 90 (middle, left and right); 91, 92, 93 (bottom)

Group 6: arm amulets and a pendant

The production and use of Islamic arm amulets seems to have been restricted to the eastern provinces; their style and the composition of their inscriptions indicate that none predates the 19th century, though all recorded examples are undated.[1] The Khalili Collection has 15 examples, of which only a selection are catalogued here. Most appear to have originated in Iran and the majority of these are Qajar products. None has overtly Shi'i features. Although a few arm amulets in another collection, which were acquired recently in Iraq, have been published, such objects have otherwise received little scholarly attention.[2]

In both Iran and Iraq arm amulets are referred to by the Persian word *bāzūband*, meaning 'armlet' or 'armband'.[3] They are made of silver or a copper alloy and have two circular lugs, either on the back of the plate or at the edges, through which a cord can pass so as to tie the amulet to the upper arm. They are often worn in pairs, one on each arm.

Arm amulets may be circular, lozenge-shaped or octagonal. Magic squares play a prominent role in their design, and cat.102 has, in addition to four standard magic squares, an interesting variation of the *budūḥ* square.[4] The sigla of the Holy Name (sometimes incorrectly called the 'Seven Seals of Solomon') also occur on several examples in the collection, such as cat.101 and 102.[5]

Some of the known arm amulets (represented here by cat.94 and 97) bear a quotation from the surah *Āl 'Imrān* (III, verse 14): 'Fair in the eyes of men is the love of things they covet: women and sons; heaped up hoards of gold and silver; horses branded; cattle and well-tilled land. Such are the possessions of the world's life; but in nearness to God is the best of the goals.'[6] The prevalence of this verse suggests that these amulets were intended to help the wearer gain worldly goods and joy. In the case of others, for example, the set cat.101 and 102, a military use might be implied by the occurrence of texts from the surah *al-Ṣaff* (LXI, verse 13, line 2), 'Help from God and a speedy victory', and surah *al-Fatḥ* (XLVIII, verse 1), 'Verily we have granted thee a manifest victory'.

The lozenge-shaped arm amulet, cat.94, portrays a woman and a man on the front, with an inscription on the reverse stating that its owner was one Musá. The silver pendant dated AH 1274 (AD 1857–8), cat.95, is a fine example of an amulet apparently meant to ensure a husband's continuing love and fidelity.[7] It shows another couple, with the male named Musá, and it is possible that the arm amulet was intended for Musá while the pendant was for his wife whom he married, perhaps, in 1857–8.

The two busts of human figures depicted on the octagonal arm amulet, cat.96, are rather different from those on cat.94. Their sex is less clearly differentiated; above one the word *nār* ('fire') is written; near the other figure a word that could be interpreted as *'ijl* ('calf') is written twice.[8] Similar figures with such labels occur on other amulets and on magic-medicinal bowls and have been interpreted as a reference to ancient symbols of the Sun and Moon, though a different interpretation of the figures, as residual elements of an early tradition of cosmic twins, has also been put forward.[9] Two fishes, often symbols of fertility and prosperity, also occur on this amulet.[10] The Qur'anic verses inscribed on it, from surahs *al-Tawbah* (IX, verse 128) and *al-Nūr* (XXIV, verse 35), are associated with general protection and divine concern for believers, and provide few clues as to the intended function of the piece.

Amulet cases that are intended to be worn on the arm are also called *bāzūband* and, like the simple arm amulets, they are restricted to eastern Islamic lands and are a relatively recent, probably 18th-century, development. The Ashmolean Museum has the earliest recorded example, a silver octagonal box dated AH 1162 (AD 1742) which bears Shi'i invocations.[11] They could also be round or almond-shaped. Fragments of miniature Qur'ans have been found in some of the octagonal and round examples.[12]

Amulet cases are often found in pairs and were apparently intended to be worn one on each arm. An example is the octagonal set cat.103 and 104, where the text begins on one and finishes on the other. It has been suggested that the texts employed on some of the cases imply that they were intended for use only by men, but this is not reflected in those in the Khalili Collection, which bear only the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255) and a quote from the surah *Yūsuf* (XII, verse 64), both verses of general benediction.[13] Nor do they have Shi'i texts or invocations, although these have been found on most of the other published examples.[14] Imitation magic squares occur on the Collection's octagonal cases, whereas floral designs dominate the other published examples.[15] No genuine magic squares are employed on any amulet case in the Khalili Collection.

1. Tawfiq Canaan (1937–8, p.90) mentions a Bedouin shaykh wearing a talismanic copper arm plate, but he does not specify the location. For arm amulets worn by Turkish soldiers in the late 19th and early 20th centuries, see Budge 1961, p.74 and pls VIII and IX. For Byzantine amulet armbands from 6th- and 7th-century Syria and Egypt, see Vikan 1984, pp.74–6 and figs 8–10.
2. See Fodor 1987–8 for a study of his personal collection of six arm amulets, all late 19th- or early 20th-century amulets more crudely executed than those in the Khalili Collection, acquired in Baghdad and including one inscribed in Hebrew; most are reproduced in Fodor 1990, pp.134–7. Three late 19th-century silver circular arm amulets from Iran, with designs incorporating the Sun rising over a lion and two figures flanking a tablet with a winged Sun overhead, have been published, though with little comment, in Gluck & Gluck 1977, p.140; they are similar in design to the first of the six arm amulets discussed by Fodor. A recent lozenge-shaped arm amulet, which has a 4 × 4 magic square, text from the surah *al-Ṣaff* (LXI, verse 13) and two sets of the sigla of the Holy Name, is in London, Science Museum, Wellcome Collection, inv. no.A128384; unpublished.
3. Fodor 1987–8, p.259.
4. See above, pp.106–107. See Canaan 1937–8, pp.101, 102 for the *budūḥ* square and its important role in talismans.
5. For the seven magical symbols forming the sigla of the name of God, see the discussion of cat.46 above.
6. The same text occurs on three other arm amulets in the Khalili Collection, TLS 12, TLS 19 and TLS 25 (ex-catalogue).
7. In early 20th-century Khurasan, Iranian folklore instructed a woman to wear a silver or brass amulet with two faces engraved side by side in order to maintain her husband's love; Donaldson 1938, pp.52, 204.
8. For examples of similar figures on other arm amulets, see Fodor 1987–8, p.273, fig.2 and p.275, figs 4, 5; Fodor 1990, p.137, no.258 and p.135, no.256. For magic bowls with similar figures see Canaan 1914, taf.I.3 and the label for no.2; Fodor 1990, no.309; and London, Science Museum, Wellcome Collection, inv. nos A639325, A155167 and A163697 (unpublished). Two human figures, more clearly delineated as male and female, often shown with a fish, appear on amulets of recent date associated with *zār* ceremonies in Egypt and the Sudan, but none of these are arm amulets; see Kriss & Kriss-Heinrich 1962, figs 115–17; Bachinger & Schienerl 1984, p.86. For the *zār* cult, see Boddy 1989.
9. For the first interpretation, see Canaan 1937–8, p.146; Canaan 1914, taf.I.3. For the second, see Fodor 1987–8, pp.268, 269.
10. See Group 3, above, for the role of fish forms in amulets.
11. Ashmolean Museum, inv. no.EA 1963.67; Gandy 1995, p.162, no.2 and p.156, fig.1. There are no Qur'anic inscriptions on the piece.
12. Ashmolean Museum, inv. no.EA 1963.67 and EA 1966–78; Gandy 1995, pp.158, 160.
13. Gandy 1995, pp.156, 157. Verse 111 from the surah *al-Tawbah* (IX), referring to death in battle, does not occur on any magical or amuletic object in the Khalili Collection. See Eruz 1993, pp.129, 130, for two 19th- or 20th-century silver octagonal examples that are said to have been attached to military banners.
14. Another amulet case in the Khalili Collection, TLS 23 (ex-catalogue), is almond-shaped and bears invocations and magical numerals but no Qur'anic verses.
15. Christopher Gandy (1995) catalogues 13 examples, either in the Ashmolean Museum or in recent London sale catalogues. For a pair in Bern, Historisches Museum, inv. no.38-1212, see Hasson 1987b, p.36, no.45. For four octagonal examples, see Sotheby's, London, 10–11 October 1990, lot nos 437, 438 and 439; and for seven round, octagonal and almond-shaped Qajar boxes, see Sotheby's, London, 10–11 October 1991, lot no.401.

94

Arm amulet

Iran, probably 19th century

Silver, engraved
width 6.9 cm *height* 5.1 cm
accession no. TLS 21

This single arm amulet could be worn vertically or horizontally: it originally had four lugs on the back (one is now missing). In the central panel a man and woman are shown above two columns of diagonal inscriptions that contain the first part of the surah *Āl ʿImrān* (III, verse 14), concluding in the vertical lines of text at the left and followed by some invocations. The four right-hand vertical lines of text contain further invocations and the *shahādah*. Inscribed on the back of the amulet is the statement 'Its owner is Musá.'

95

Pendant

Iran, dated AH 1274 (AD 1857–8)

Silver
width 6.1 cm *height* 8 cm
accession no. TLS 22

This silver pendant was apparently intended to ensure lasting love. On one side two figures, a man and a woman, are shown embracing. The woman wears an elaborate headress, suggestive of wedding attire, and the man wears a crown. The disk of the radiant Sun appears behind his head and the date AH 1274 (AD 1857–8) is written between their waists. Near the elbow of the seated male figure the name Musá is written, and it is possible that this Musá is the same as the owner of the arm amulet cat.94. The invocation *yā khāliq* ('O Creator!') is repeated 42 times around the figures.

On the reverse of the pendant the man is shown standing with his left hand behind his back and his right hand raised. Another radiant sun appears behind his head and around the figure there are engraved prayers and Qur'anic phrases, including text from the surah *Ṭā'-hā'* (XX, verse 135).

96

Arm amulet

Iran, 19th century

Silver, engraved
height 6.4 cm *width* 6.7 cm
accession no. TLS 20

This arm amulet has bust-length representations of two human figures, not easily distinguishable as male and female, in the middle top square of a nine-cell central design. Around these figures magical numerals, the word *nār* ('fire') and the letter *bā'* are written. In the cell at top-left are two words that could be interpreted as *ʿijl* ('calf'). The central cell has text from the surah *al-Tawbah* (IX, verse 128) surrounded by magical numerals. Two fishes, labelled *ḥūt* ('fish'), appear in the lower middle cell; magical numerals and letters fill the ground and the two adjacent corner cells. The rectilinear border is filled with text from the surah *al-Nūr* (XXIV, verse 35).

97

Arm amulet

Iran, 19th century

Silver
height 6.6 cm *width* 7.1 cm
accession no. TLS 18

This silver amulet was apparently made by the same workshop that produced cat.96. It features a central magic square that yields a common sum of 520. Around this square are written the names of the four Archangels and the whole is inscribed within a circle, the ground of which is filled with magical numerals. Text from the surah *al-Tawbah* (IX, verse 128) occupies the two horizontal bands above and below the central design. The rectangular border is filled with text from the surah *Āl ʿImrān* (III, verse 14) followed by invocations. The back of the amulet is blank.

129	133	136	122
135	123	128	134
124	138	131	127
132	126	125	137

98

Arm amulet

Iran, 19th century

Brass
diameter 5.2 cm *depth* 1 cm
accession no. TLS 12

On the front of the amulet, a ring of eight cartouches contains prayers that continue in the eight, horizontal, cartouches forming the central design. The text ends with a quotation from the surah *Āl ʿImrān* (III, verse 14), which fills the last three and a half cartouches. On the back, a later hand has inscribed text from the surah *Yūsuf* (XII, verse 34) between two lugs.

99, 100

A pair of arm amulets

Iran, 19th century

Silver
width 6.2 cm *height* 4.4 cm
accession no. TLS 26A

width 6.4 cm *height* 4.5 cm
accession no. TLS 26B

These lozenge-shaped arm amulets form a set, with the text that begins on one finishing on the other. A quotation from the surah *al-Qadr* (XCVII, verses 2–4) is engraved on cat.99, with verses 4–5 from the same surah and *al-Ṣaff* (LXI, verse 13, line 3) engraved on cat.100.

101, 102

A pair of arm amulets

Iran, 19th century

Silver
diameter 6.9 cm
accession no. TLS 27A

diameter 7 cm
accession no. TLS 27B

On the front of each circular silver arm amulet there is a ring of eight small medallions containing invocations to God. The central medallion on cat.101 contains a quotation from the surah *al-Ṣaff* (LXI, verse 13, line 2), 'Help from God and a speedy victory'; that on cat.102 has surah *al-Fatḥ* (XLVIII, verse 1), 'Verily we have granted thee a manifest victory.' Such verses suggest that the amulets were intended to provide protection in battle.

The reverse sides of both amulets are carefully engraved with magic squares. Cat.101 has a single 4 × 4 square yielding a common sum of 50,474. Around the edges are inscribed the sigla of the Holy Name (the so-called 'Seven Seals of Solomon') and sequences of numerals, for the most part repetitions of 731. Three concentric rings of magical numerals and letters enclose the design. On cat.102 there are four 4 × 4 magic squares with common sums of 914, 9074, 514 and 5314. There is also a 3 × 3 square yielding a common sum of 165; it is a basic *budūḥ* square with the numerical value of each letter-numeral repeated for two digits. Near these squares are further sequences of magical numerals and two sets of the sigla of the Holy Name, with the pentagram in one set replaced by a circle.

magic square on cat.101			
12618	12621	12624	12611
12623	12612	12617	12622
12613	12626	12619	12616
12620	12615	12614	12625

magic squares on cat.102			
221	232	226	235
234	227	229	224
231	222	236	225
228	233	223	230

2268	2271	2274	2261
2273	2262	2267	2272
2263	2276	2269	2266
2270	2265	2264	2275

121	132	126	135
134	127	129	124
131	122	136	125
128	133	123	130

1328	1331	1334	1321
1333	1322	1327	1332
1323	1336	1329	1326
1330	1325	1324	13345

44	99	22
33	55	77
88	11	66

103, 104

Pair of amulet cases

Iran, 19th century

Silver
maximum diameter 5.6 cm
depth 2.7 cm
accession nos TLS 24, TLS 45

This pair of octagonal amulet cases, made to be worn on the upper arm, are engraved with the 'Throne Verse' from the surah *al-Baqarah* (II, verse 255, lines 1–7), which begins on the lid of cat.103 and finishes on the lid of cat.104, where it is followed by a quotation from the surah *Yūsuf* (XII, verse 64, lines 3–4).

On the bottom of each case there is a 4 × 4 square whose cells are filled with nonsensical numbers. The square is surrounded by the names of the four Archangels, and the whole design is framed by two octagonal zigzig bands enclosing another band of magical numerals in which 2811 is endlessly repeated. On four sides of each case the invocations 'O Praiseworthy One!', 'O Compassionate One!', 'O Benefactor!' and 'O Godly One!' are written. The sides with the hinge and clasp are engraved with flowers growing from a pot, while the two faces with small lugs are framed by rows of magical numerals.

94 (top left); 95 (top right); 98 (middle); 101 front and back (bottom left); 102 front and back (bottom right)

96 (top left); 97 (top right); 99, 100 (middle); 103, 104 (bottom)

Divination

by Emilie Savage-Smith

opposite page
Figure 5
Formation of the first four 'figures' of a geomantic tableau

Figure 6
A geomantic tableau
After Savage-Smith & Smith 1980, p.12

Of the numerous practices employed in the medieval Islamic world to foretell future events or discern hidden things, astrology was by far the most popular.[1] Its primary application was in the preparation of horoscopes. These were intended to indicate the influence of the stars and planets on a person either at birth or at other times in his or her life, though horoscopes were also commonly used to determine the wisdom of undertaking a particular course of action.

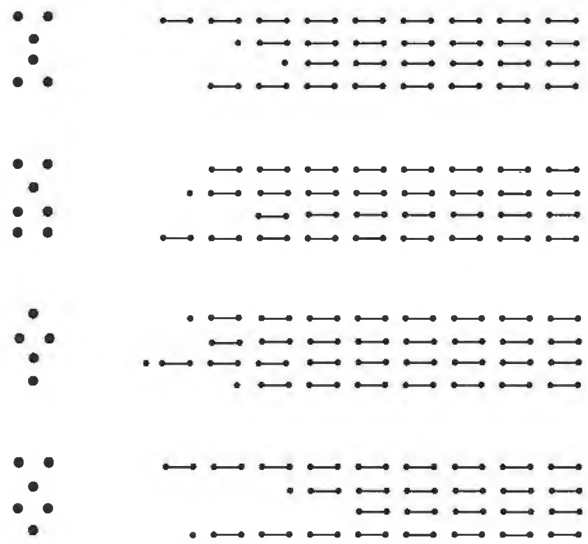
Innumerable treatises and practical manuals were compiled to help astrologers remember the complex procedures and copious information necessary to interpret a horoscope. Another type of *aide-mémoire* took the form of an implement that superficially resembles a celestial globe. The type, of which there are two examples in the Khalili Collection (cat.113 and 114) has not been previously recorded, but all the known examples are unsigned and undated, and inscribed in a mixture of Arabic, Persian and Urdu, indicating that they are products of a recent workshop in north-central India.[2]

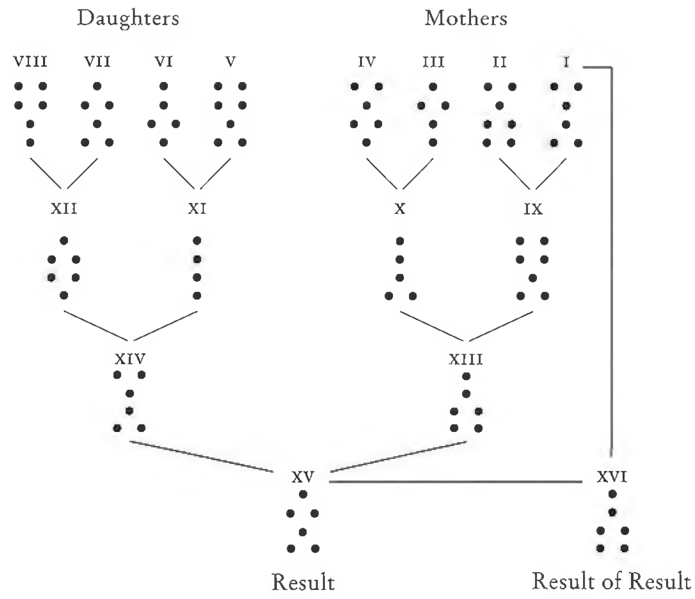
Another item from an even more recent Indian workshop, cat.112, bears astrological decorations that imply its use by astrologers and divinators. It may have been an astrologer's ceremonial standard or perhaps a badge or symbol of his services, but its precise function is unknown, and no comparable piece has been recorded.

Of all divinatory practices used in Islamic cultures, it seems that only astrology was more popular than that known in Arabic as *'ilm al-raml* ('the science of the sand'), which came to be known as geomancy in medieval Europe.[3] The origin of the distinctly Islamic art of geomancy is a matter of speculation, but it appears to have been well established in North Africa, Egypt and Syria by the 12th century. Unlike astrology, geomancy did not require astronomical observations and calculations. Instead, divination was accomplished by forming and then interpreting a design, called a geomantic tableau, consisting of 16 positions, each occupied by a geomantic 'figure' (fig.5). The figures occupying the first four positions were determined by marking 16 horizontal rows of dots on a piece of paper or a dust board (*takht*), a tablet covered with fine sand on which numerical or other calculations could be made and then easily erased (fig.6). Each row was examined to determine if it contained an odd or even number of dots, and it was then represented by one or two dots. The first four lines of dots determined the first figure, the second four lines the next, and so on. Each of the four figures is a vertical column of four marks, each mark consisting of either one or two dots. From these four figures the remaining twelve positions in the tableau are produced according to set procedures.[4]

Geomancy had its own distinctive literature, with numerous manuals written as aids to remembering the multitude of alignments and attributes necessary to interpret a geomantic tableau. Various interpretative methods were advocated, and the significance of each of the 16 possible geomantic figures varied depending upon the nature of the question asked. The practice tended to give answers to more specific questions than astrology, and was used not just to prognosticate the future – popular questions included those concerning the course and seriousness of an illness or the outcome of a pregnancy – but also to learn about unseen events or objects, such as the fate of distant relatives, the location of lost or buried objects or a person's unspoken thoughts. Many of these questions could also, of course, be addressed to an astrologer, who employed different procedures to arrive at a prediction.

Astrology and geomancy were often combined. In one of the stories in *The Thousand and One Nights*, for example, Qamar al-Zaman, pretending to be a fortune-teller to gain access to the palace and the king's daughter, carries as tools of his trade 'a set of instruments, as well as a [geomantic] divination tablet and an astrolabe of gold'. He calls out, 'I am the scribe, the calculator, the astrologer. I am he who calculates, who knows what is hidden,





who divines the answers, and who writes charms. Where is the seeker?'[5]

The Khalili Collection has two extraordinary examples of artefacts that combine astrological with geomantic divination. No similar items have been recorded. One, a thin brass plate (cat. 108), has the overall appearance of an astrolabe but there the similarity ends. It was perhaps intended to help the user decide on courses of action that might increase his stature in society or gain favour among the powerful, for at the top of the plate there is an Arabic inscription calling upon God: 'Raise up my position, O Exalter of ranks!' The body of the plate is engraved on both sides with numerous inscriptions in Persian, laid out in concentric circles, which present a gazetteer as well as astrological alignments and an arrangement of geomantic figures.[6] It is difficult to determine precisely where and when this object was manufactured. It is a skilfully executed piece of Iranian metalwork that is in keeping with the output of a late Safavid workshop.

The second item, a length of painted textile (cat. 105), also appears to be unique. It is essentially a short astrological and geomantic text written on cloth and illustrated with miniature paintings; the text has even been corrected with marginal notations as if it were a manuscript. The texts from which the designer and copyist gathered the material are unknown. It is interesting, however, that the larger of the two circular diagrams in the lower corner of the textile resembles a diagram that occurs in a Persian astrological treatise, *Kitāb-i Sā'āt* ('The Book of Hours'), which was written for Mirza 'Aziz Koka, an important official in the service of the Mughal emperor Akbar in the 16th century.[7] In addition, the paragraph of text next to this diagram on the textile is concerned with the rainbow, and the text preceding the diagram in the manuscript treatise is concerned with the same subject.

Both the calligraphy and the illumination are of good quality and carefully executed. The textile is undated and unsigned, but the headgear, beards and profiles of the painted human figures suggest that it is a late Mughal, probably provincial, product of the early 18th century. It also displays Indian influence in its three illustrations of a mongoose and in its provision of equivalent Indian terms for the lunar nodes. Painted textiles were frequently made in the 17th and 18th centuries in India, particularly in Golconda in the Deccan but also at other places in northern India.[8] They often served as tent hangings or as a cover for a ceremonial gift, a *rumal*. The precise purpose of this charming item is not known: it may have served as a portable astrological manual; or it may have been thrown onto a table to impress the fortune teller's prospective clients; or perhaps it was hung on the wall as a symbol of the art or even as an *aide-mémoire*.

In Iran the term *raml* is applied to two types of divination. One type is the traditional form of geomancy described above. The other, frequently described by European travellers, involved the throwing of brass dice strung together in groups of four.[9] Although these are commonly called 'geomantic dice', their markings do not produce a geomantic figure. Divination using such dice is a form of lot-casting or sortilege (*fa'l*) rather than true geomancy.

The Khalili Collection has thirteen sets of 'geomantic dice', varying in length from 5.9 centimetres to 12.3 centimetres (cat. 107). They were probably all made in Iran during the

18th to 20th centuries. While they vary in small details, such as the shape of the two end-pieces holding each set together or whether or not the markings are enclosed by circles, they are all fundamentally identical. Each of the four dice in a set has four sides bearing dots: one face has two dots, two faces have three dots each and the remaining face has four dots. There are no sides with a single dot. This is in contrast to the description given by E.G. Browne of his encounter with a geomancer or *rammāl* in the Iranian village of Khuy on 26 October 1887:

'This votary of the occult sciences, Mírzá Taḳí by name, was a native of Kirmánsháh. So far as I could see, he never quitted his cell, dividing his time between opium-smoking, tea-drinking and casting the four dice-like brass cubes pivoted together whereby he essayed to unravel the mysteries of the future. After offering us a share of his tea, he proceeded to cast his dice and tell me my fortune, scribbling on a piece of paper the while, somewhat as follows: — "*Three, two, one, two*" (counting the numbers uppermost on the dice), "Praise be to Alláh! thou wert born under a lucky star. *One, one, three, four*; thy journey will be a long one, and seven months at least will elapse ere thou shalt again see thy native land. *Two, two, four, two*; I take refuge with Alláh, the Supreme, the Mighty! What is it that I see? Thou shalt without doubt incur a great danger on the road, and indeed it seemeth to me that one will attempt thy life before thou reachest Tabríz. *Four, three, one, four* ..." '[10]

One of the leading Iranian artists of the 20th century, Mirza Muhammad Ghaffari, usually known as Kamal al-Mulk (d. 1940), produced an oil painting showing a fortune teller using a similar set of brass dice strung together, which he has thrown onto a flat circular plate.[11] Unfortunately, it is impossible to see if the dice are of the same form as those catalogued here, that is with two faces of three dots and none with a single dot.

Two examples of an unusual form of brass lot-casting piece are also in the Khalili Collection (cat. 111). They are of solid brass with cryptic letters engraved on the four faces. Each face also bears a numeral from 1 to 4, in addition to three letters or symbols that differ on each face and one letter, *ghayn*, that is constant.

Rectangular, bone lot-casting pieces closely resemble the ivory rectangular dice used for game playing that have been excavated in Fustat and assigned to the 9th to 11th centuries.[12] The lot-casting pieces, however, differ from the gaming pieces in the number of dots inscribed on each of the four faces. On the elongated sides there are either one, two, three, or four carved circles, yielding the sum of 10 for the four sides of a die, with no constant sum for opposite faces. In contrast, opposite faces on rectangular gaming pieces, which also have only four faces, have 1 or 6 dots and 2 or 5 dots, so that the sum of the opposite faces is 7. They were apparently used in the game of *nard*, which employed astrological concepts of day and night, days of the week, months of the year and zodiacal signs. Examples of ivory or bone rectangular lot-casting pieces with concentric cirles arranged in a 1–2–3–4 sequence on the faces do occur in other collections, but there has been no comprehensive study of them.[13] The Khalili Collection has one typical example (cat. 109) and one, more unusual and possibly older piece (cat. 110), on which one can detect traces of a bird design and scorpions carved within the circles.

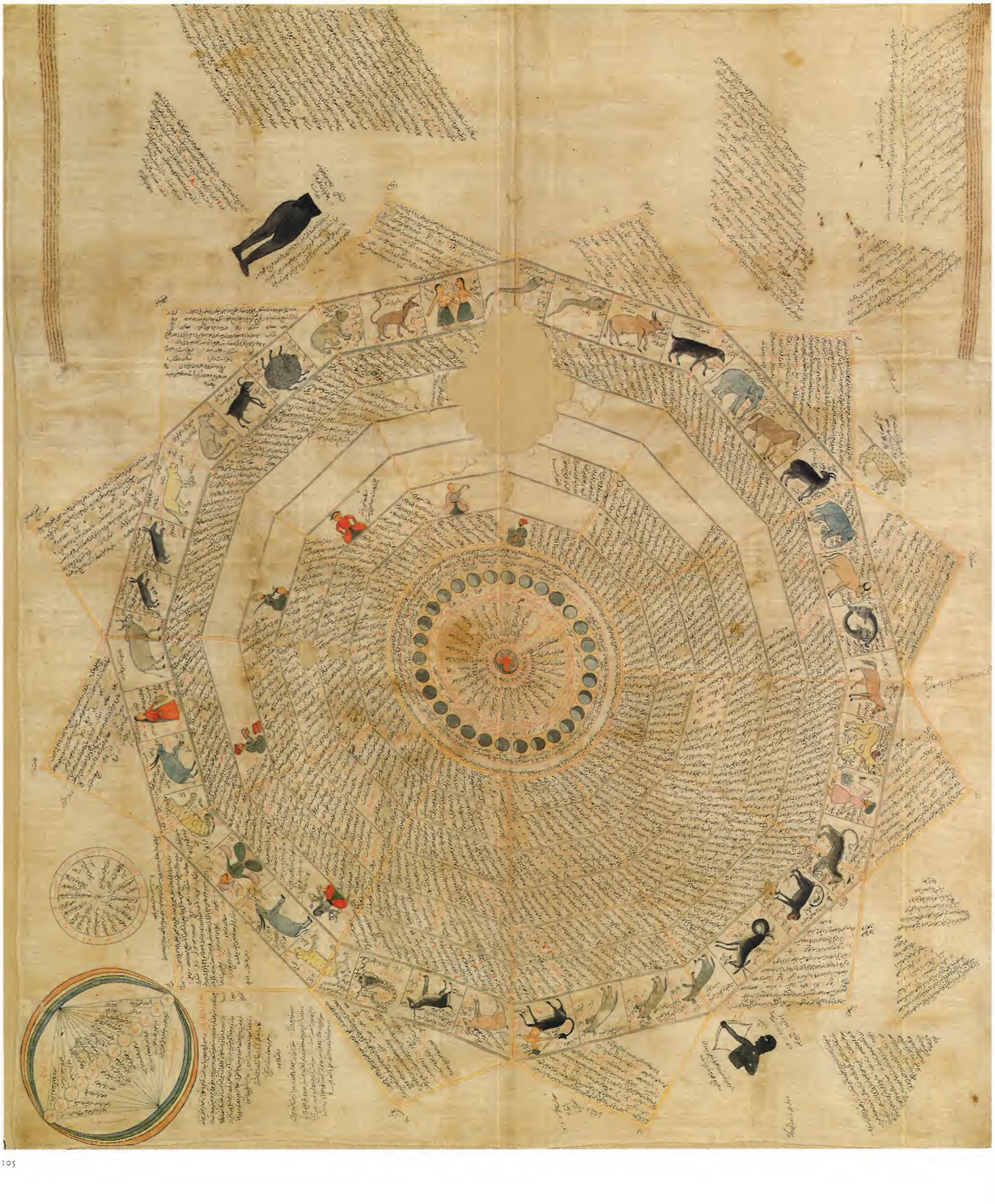
One of the most popular forms of lot-casting was bibliomancy (*fāl-nāmah*), which involved the random selection of a passage from a written text – usually the first the eye fell upon – and its interpretation in the context of a specific question.[14] Collections of poems could be used, especially the *Dīwān* of Hafiz, or special treatises with charts or circular diagrams specifically designed for this type of divination. Most popular, however, was the use of the Qur'an itself, preceded by the reading of certain verses such as the 'Throne Verse'

from the surah *al-Baqarah* (II, verse 255) and special prayers. The Khalili Collection has a very large-format Persian treatise on bibliomancy (cat.106), which includes a chart showing the propitious times and days of the week for engaging in bibliomancy employing the Qur'an, according to the Imams of the Twelver Shiʿi community.

Divination found widespread popularity amongst all strata of Islamic society, despite the condemnation of clerics. Lot-casting, particularly that employing dice, was the form of divination that was most accessible, both to would-be practitioners and to clients. It required the least learning to practise it, and for this reason there were no doubt more diviners practising lot-casting that any other form of divination. Lot-casting may also have had a large following because it was considered to have originated in pre-Islamic Arabia and hence Islamic jurists and clerics were not as disapproving.

Astrology was the form of divination requiring the greatest education, for the practitioner had to know astronomy and mathematics in order to cast a horoscope, as well as how to use astronomical instruments.[15] The most learned of astrologers would also have been versed in the Aristotelian philosophy which underpinned astrological doctrines. Other forms of divination, such as geomancy, incorporated many of the astrological principles into their art, but did not require much knowledge of astronomy or mathematics to produce the forecast. Nevertheless, geomancy, in particular, was sufficiently complex to require extensive apprenticeship and *aide-mémoires*. Apprenticeship was probably the main method by which the divinatory practices were acquired and transmitted through generations, with divinators constantly striving to invent more convenient mnemonics for the numerous alignments and procedures that had to be recalled when constructing the final prognostication. There is considerable evidence that astrologers, and presumably other divinators, who were not court advisors or patronized by the wealthy, practised in the streets rather than in shops, markets or stalls, and women seem to have formed much of the clientele of the street divinators.[16] The artefacts discussed in this chapter include instruments and aids of both the highly literate class of astrologer and divinator and the relatively uneducated street practitioner of lot-casting.

1. For divinatory practices in Islam, see Irwin 1994, pp.188–94; Fahd 1966; and Doutté 1908.
2. In addition to the two examples in the Khalili Collection, a similar object was brought into Christie's, London, for examination in 1989 and later withdrawn from sale; its present location is unknown. A fourth example is in the collection of R. Kaplan in Los Angeles.
3. The term geomancy comes from the Latin *geomantia*, first used in Spain in the 12th century. The practice is to be distinguished from a totally unrelated Chinese form of prognostication based on land forms, unfortunately also called geomancy in English.
4. For geomantic figures and the practice of geomancy, see Smith 1979; Savage-Smith & Smith 1980; and Fahd 1978b.
5. Haddawy 1995, p.197; for the Arabic text, see *Alf laylah wa-laylah*, II, pp.18–19. See also the translation by Richard Burton (*Alf laylah wa-laylah*–Burton, pp. 1117–8), who stresses that it is a divination tablet used in geomancy that is specified.
6. A detailed study of the design and function of this plate, as well as possible instrument-makers' workshops where it might have been produced, will be published separately.
7. The illustration, from a copy of the treatise completed on 21 Shawwal 991 (7 November 1583), is reproduced in Geneva 1985, p.149. It will be noted, however, that the subject matter of this particular diagram is different.
8. For examples, see London 1982, nos 209–13 and 239–43.
9. For example, see Browne 1893, p.58; Donaldson 1938, p.194; and Massé 1965.
10. Browne 1893, p.58.
11. Reproduced in Titley 1983, p.129, fig.50.
12. See Contadini 1995, especially pp.127–9 and 136–7.
13. For an example in the Musée du Louvre, see Paris 1977, p.212, no.478a.
14. See Lane 1836/1908, pp.267–8; Massé 1965; and Fahd 1986.
15. For the role of astrologers in medieval Islamic society, see the excellent study by Saliba 1993. See also Sayılı 1960, pp.8–49
16. Saliba 1993, pp.61–63.



105

An illustrated astrological text on cloth

India, 18th century

Three pieces of cotton cloth, one (96 × 76 cm) plain, and two (49 × 36 cm) with a single woven-in band (1.5 cm wide) of five stripes, perhaps originally green, with red edges, set 3.6 cm in from the sides; the three sewn together to form a panel 111.5 × 97.5 cm, inscribed in *naskh* script in black ink, with rubrications, and painted with motifs in ink and opaque watercolours; there is a later note in *nasta'līq* script
accession no. TXT225

This attractive painted textile has no known parallels. The Persian text it bears is essentially a short treatise on astrology, with some geomantic elements. It has been corrected by the scribe and then again by a later user, much as is done with a manuscript. A much later 'reader' has added an extensive marginal note in *nasta'līq* script in the top right-hand corner, supplying yet more guidance on astrological prognostication. Both the original *naskh* inscriptions and the illustrations were carefully and skilfully executed.

105, detail of Indian elephant

In the centre of the textile there is a depiction of a crowned figure sitting cross-legged inside a crescent moon – the human personification of the Moon. Surrounding this figure are seven concentric circles, the first six divided into 30 compartments. In the innermost circle, these compartments are numbered 1 to 28, with two blank. In the second ring, the word *al-muḥāq*, meaning the dark period between the old and new Moon, is written in one space, another compartment is blank, and the remaining 28 are filled with brief statements about the occurrence of the moon in that particular phase. In the third ring there are letters of the alphabet and other items associated with the phases of the Moon (*aḥkām-i qamar*), while in the fourth ring related zodiacal signs are named. In the fifth and most evident of the rings there are pictorial representations of the phases of the moon. The sixth ring contains a list of actions recommended for particular lunar phases: for example, during the 21st phase, 'It is good to build a mosque or a madrasah.' The seventh, undivided, ring has two lines of text on the Moon's phases.

105, detail of monkey

Enclosing the circular design are seven concentric dodecagonal registers. Each of the first six contains a seated figure personifying one of the planets, and an accompanying Persian text giving the astrological attributes, physiognomic and symbolic associations of that planet, as well as its general significance when it appears in each of the 12 zodiacal houses. Proceeding outwards, the planets are Mercury, who is shown as a scribe; Venus, portrayed as a lady playing a lute-like instrument; the Sun, who has radiating dark hair and is posed frontally, with hands resting on thighs and elbows turned outwards; Mars, who is shown as a warrior holding a severed head by the hair; Jupiter, depicted as a man in a turban reading a book; and Saturn, who is a bare-chested figure with a beard and long hair, and six or seven arms holding various objects.

The outermost register contains emblematic representations of the 12 signs, arranged in an anti-clockwise sequence. Between the zodiacal signs are two or three animals, with given attributes. Each animal primarily represents a lunar mansion that is named first in each cell. Since there are 28 lunar mansions and only 12 zodiacal signs, the distribution of animals representing lunar mansions among the zodiacal signs is uneven. Beginning with Aries (in the panel immediately above the head of the central lunar figure), the sequence is: a horse, an elephant, a sheep, Taurus, two snakes in succession, Gemini, a dog, a cat, Cancer, a mountain goat, a cat, Leo, two rats, an ox, Virgo, a buffalo, a tiger, Libra, a buffalo, a tiger, Scorpio, a gazelle, a deer, Sagittarius, three mongooses, Capricorn, a monkey, a dog, Aquarius, another dog, a horse, Pisces, an ox, and an elephant. The final, 28th, lunar mansion is illustrated by a leopard placed outside the final ring.

On each of the 12 sides of the outer register there is a triangle enclosing general information on the zodiacal sign that is illustrated in the ring beneath and on how it relates to the lunar mansions and the planets. On opposite sides of the diagram there are two parts of a dark-skinned male figure severed at the waist. The upper half is to the right side and is shown drawing a bow. It represents the northern lunar node referred to as the head (*ra's*), usually the head of a dragon. The lunar nodes are the northern and southern intersections of the Moon's orbit with the ecliptic. Every time a conjunction or opposition of the Sun and Moon occurs near these lunar nodes, a solar or lunar eclipse occurs. The southern node, called the tail (*dhanab*), is represented to the left of the main diagram by the lower part of the body.[1] The upper portion of the dark severed body is also associated with the geomantic figure called *qabḍ al-khārij* and the lower half of the body with the one called *'atabah khārijah*. The remaining 14 geomantic figures are written and labelled at points of the 12 triangles, with two given at both the house of Leo and the house of Cancer.

In the bottom corner, beneath the large 12-sided diagram, are two small circular ones. The smaller of the two is divided into 12 segments with the names of the zodiacal houses associated with certain types of people and livelihoods. The larger circle has the 12 zodiacal houses named, each in a small circle, and arranged along a diameter of the circle and coincident with the vertical axis of the nested dodecagons. Radiating from the 'poles' of this diameter are lines with the spaces between them filled with information on directions, elements and others astrological values.

105, detail showing the figure of Saturn

Several additional paragraphs in the margins of the rectangular textile give basic astrological information and principles, including one on the significance of the lunar nodes and one on the rainbow (*qaws-i quzaḥ*).

1. Some have maintained that whenever the tail of the centaur in the constellation Sagittarius is drawn with a knot and a dragon's head at the tip of the tail, as it is on this painted textile, the reference is also to the lunar node called the tail of the dragon, whose exaltation was thought to be in Sagittarius. See Hartner 1938, pp.135–8; Hartner 1965; Hartner 1973. For a counter-argument, see Rogers 1969, pp.154–5, n.15 (reading 'lunar node' instead of 'exaltation of Draco').

105, detail showing the figure of Venus

طریق اول

در بیان تفأل بکلام الله چون ابتداء بفال مصحف کنی اول تکبیر بگو و بعد
از آن سه مرتبه سورهٔ قل هو الله احد بخواند و بعد از آن سه مرتبه بخواند
و سه مرتبه صلوات بر محمد و آل محمد بفرستد و دعا اینست بسم الله
الرحمن الرحیم اللهم انی توکلت علیک و تفألت بکتابک فارنی
من کتابک ما هو المکتوم فی سرک المکنون فی غیبک اللهم انت
الحق انزل علی الحق بحرمة محمد الحق بعد از آن مصحف را بگشاید اگر الف آمد
الا ان اولیاء الله لا خوف علیهم و لا هم یحزنون بدان ای خداوند فال
که از اندوه و رنج آزاد شدی اگر دست بر شاخ خشک میوه چینی و اگر
ب باشد بشیرا و نذیرا الی الله بدان ای خداوند فال بشارت باد تورا
که خداوند تعالی نعمت جاوید دهد تورا و شادمان شوی و اگر ت
باشد تالله لقد ارسلنا الی امم بدان ای خداوند فال که یکچند صبر کن و توبه
کن از کارهای حرام و فسق و ظلم تا از جمله بلاها ایمن شوی و اگر ث باشد
ثیاب سندس خضر و استبرق بدان ای خداوند که از جور و اندوه رستی
که فال تو نیکو آمده است و بتو نعمت رسد و اگر ج آید جهنم و بئس المصیر

106, folio 4b

اوقات استخاره

در بیان اوقات استخاره است

جدول معرفت اوقات استخاره منقول از ائمهٔ طاهرین صلوات الله وسلامه علیهم اجمعین که در هر روزی از ایام هفته چه وقت باید استخاره نمود

نیک و بد ساعات ایام اسبوع

روز شنبه از طلوع صبح صادق تا طلوع آفتاب پس از ظهر تا وقت عصر

روز یکشنبه از صبح صادق تا ظهر و پس از عصر تا وقت مغرب

روز دوشنبه از صبح صادق تا طلوع آفتاب پس از چاشت تا ظهر

روز سه شنبه از چاشت تا ظهر و پس از عصر تا وقت خفتن

روز چهارشنبه از صبح صادق تا وقت زوال و پس از عصر تا وقت خفتن

روز پنجشنبه از صبح صادق تا طلوع آفتاب و پس از چاشت تا عصر و پس از مغرب تا خفتن روز جمعه از صبح صادق تا طلوع آفتاب و پس از چاشت تا عصر و پس از مغرب تا وقت خفتن والسلام

106, folio 8a

106

A treatise on bibliomancy

Iran, 19th century

8 folios, 50.5 × 31.5 cm, of a thin, highly burnished paper with fine laid lines but no visible chain lines; text area 19.5 × 36.5 cm, framed by black, gold, green, red and blue lines; and containing 14 lines of an imposing *naskh* hand written in black with numerous rubrications, some in *riqāʿ*; there is a larger gold and black frame; part of a title is written at the top of each page, in red *riqāʿ* within a gold frame of arabesque elements; folios 1a and 8b are blank
binding modern cloth covers
accession no. MSS 412

This anonymous and undated Persian manuscript opens with a talismanic chart of a Twelver Shiʿi character (folio 1b; see p.58 above).[1] The title for the chart and the text on folios 1b–2a is *Ru'yah-i hilāl* ('Seeing the new moon'), and indeed the chart ends with talismans to be viewed under these conditions, while folio 2a and part of 2b give a fully vocalized Arabic prayer to be recited upon seeing the new moon.

Folios 2b–4a, entitled *Fī bayān al-waqf* ('In explanation of pausing'), contain a summary of the widely used system of Qur'an recitation developed by Muhammad ibn Tayfur al-Sajawandi (d. *circa* 1165), in which seven types of *waqf*, or pause, were employed, each designated by a letter of the alphabet.[2]

The next opening is entitled *Fī ṭarīq al-istikhārāt* ('On the method of bibliomancy'). The term *istikhārah* means entrusting to God the choice between several options, and is applied to divination through dreams as well as by selecting passages from the Qur'an at random, the sense employed here.[3] In the title of the subsequent opening (folios 5b–6a), the practice is also referred to as *tafā'ul* ('casting fortunes'), though the earlier term *al-istikhārāt* is employed again in the title for the opening of folios 6b–7a and at the top of folio 7b. Several procedures are given, including one taken from the *Kitāb al-istikhārāt* ('Book of bibliomancy') by an otherwise unknown authority named Ibn Ta'us. According to his method, anyone wishing to tell their fortune by consulting the Qur'an should first read the 'Throne Verse', then say a prayer for the Prophet ten times, then repeat the prayer specified in the text, and then open the Qur'an and note any of the *asmā' al-ḥusnā* occurring on the right-hand page. Then he is to move to the tenth page after that page and look at the tenth line of the left-hand opening; therein will lie the revelation (*waḥy*). Other bibliomantic methods are given at the bottom of folio 7b, including one attributed to Hajji Mirza Muhammad Hasan Hujjat al-Islam, the great Imami Shiʿi *mujtahid* who died in 1894.[4]

The final page, folio 8a, has a different title in the cartouche at the top, *awqāt al-istikhārāt* ('The appropriate times for bibliomancy'). A list is given of the propitious times and days of the week for undertaking such procedures, as attributed to the Imams recognized by the Twelver Shiʿi community.

These texts are all very carefully and elegantly transcribed by the same scribe in a continuous text. It is unusual for these three topics – talismans, Qur'anic recitation and divination – to be deliberately combined in one volume.

1. I should like to thank Professor Wilferd Madelung for his assistance with the Persian text.
2. Brockelmann 1889–1936, I, p.408; Brockelmann 1937–1942, I, p.724. For a copy of his treatise, *Kitāb al-waqf wa'l-ibtidā'* ('The book of stopping and starting'), see Bodleian Library, Oxford, MS.Arab.e.204, folios 1–60. For this and similar treatises on recitation patterns for the Qur'an, see Pretzl 1934, pp.10 and 234–8.
3. See Fahd 1978a; 1986.
4. I'timad al-Saltanah 1363–8, I, pp.186–7; II, p.745. Hajji Muhammad Hasan played a major role in having the tobacco monopoly revoked in 1891–2 (see Lambton 1987, pp.247–58, for example). My thanks to Manijeh Bayani for these references.

107

Thirteen sets of 'geomantic' dice

Iran, 18th–20th centuries

Brass
12.5 × 1.8 × 1.8 cm
accession no. SCI135A, B

12.0 × 1.9 × 1.9 cm
accession no. SCI135C

7.2 × 1.5 × 1.5 cm
accession no. SCI135D

8.3 × 1.3 × 1.3 cm
accession no. SCI135E

8.9 × 1.5 × 1.5 cm
accession no. SCI135F

7.9 × 1.2 × 1.2 cm
accession no. SCI135G, H

6.1 × 0.9 × 0.9 cm
accession no. SCI135I

6.4 × 1.0 × 1.0 cm
accession no. SCI135J

6.8 × 1.0 × 1.0 cm
accession no. SCI135K

5.9 × 0.8 × 0.8 cm
accession no. SCI135L

5.9 × 0.8 × 0.8 cm
accession no. SCI135M

Each of the sets consists of brass dice strung together in groups of four and held with two decorative brass end-pieces. The components of the sets vary slightly in size and in the shape of the end-pieces, some of which are elongated and some spherical or knob-like.

Only four faces of each die are visible. The majority of dice are engraved with circles with central dots, but four sets have simple drilled depressions. None of the dice have faces with a single dot. On each of two opposite faces there are sets of three dots, while the other two faces have two dots and four dots; these are arranged in the following configuration:

	3	
2		4
	3	

The sum of the engraved faces of each die is 12. Though they have often been called 'geomantic dice', they cannot produce a geomantic figure.

108

Astrological geomantic plate
Iran, 17th or 18th century

Brass sheet, engraved
21.6 × 17 × 0.15 cm
accession no. SCI33
provenance formerly in the collection of Alain Brieux, Paris

This carefully executed divinatory plate has a projection at the top reminiscent of the *kursī* of an astrolabe. The front of this projection is engraved in Arabic with the exclamation, 'Raise up my position, O Exalter of ranks!' A small hole at the top would permit suspension by a wire hook or thread. The reverse of the projection is blank. At the bottom of the plate there is a smaller projection, which is blank except for a framing band, and there are two other, very small, projections placed asymmetrically at the sides of the plate.

The plate itself is covered on both sides with numerous Persian inscriptions laid out in concentric circles and engraved on stippled or hatched grounds. In the centre of the front face there is a circular medallion with a lightly engraved inscription, which may be a later addition. The significance of the inscription is not immediately evident and invites various interpretations. The top word might be read as *sāl* ('year') with two numerals and three letters beneath. If these are read as a chronogram and the numerical values of the letters added to the numbers, then the inscription might be interpreted as *sāl tādh 41*, ('the year 1142 [AD 1729–30]').

Around this central circle there is a ring of seven medallions containing personifications of the planets. Proceeding anticlockwise, they are the Moon, Mercury, Venus, the Sun, Mars, Jupiter and Saturn. In the next concentric ring there are 12 zodiacal signs represented emblematically in medallions, proceeding anticlockwise from the top.

The concentric rings enclosing this central design are divided into two halves by columns of labels at about 100° and 280°. The column at 100° defines the contents of the five concentric half-circles in the top field. These constitute a gazetteer for 34 localities in Iraq, Iran, Central Asia, Afghanistan and India: their names are given in the outermost half-circle, followed by the longitude, latitude, *inḥirāf* (that is, azimuth of the *qiblah*) and distance from Mecca. The column at 280° describes the contents of the eight concentric half-circles in the lower field. Here the lunar mansions named in the outermost half-circle are shown aligned with the zodiacal houses and assigned degrees, minutes, letters of the alphabet, natures, planets, and 'limits' (*ḥudūd*).[1] A band of scrolling vines encloses the complete design.

On the reverse of the plate, the central circular area is blank and is enclosed by 11 concentric rings. Beginning with the inside ring, these rings contain information giving strength/weakness, animal/vegetable/mineral, colours, planets, zodiacal houses, geomantic figures, letters of the alphabet, the ages in life, numerals, a band of graduations with no labels, and a band of numerals on the outside ring.

A detailed study of the nature and function of this plate will be published separately.

1. For this astrological property, see Asadullah Mirza–Elwell-Sutton 1977, pp.62–3.

109, 110

Two lot-casting pieces
Provenance and date unknown

Bone, 9.2 × 1.4 × 1.4 cm
accession no. MXD 172

Bone, 8.2 × 1.7 × 1.7 cm
accession no. MXD 205

The four faces of cat.110 are inscribed with one, two, three and four large circles, each with a dot at the centre and traces of carved bird and scorpion designs. At either end there is a border of four inscribed lines. The piece is unusual and possibly somewhat older than the second example, cat.109, on which the main circular devices consist of a deeper central dot surrounded by three concentric circles. The grounds between the main circles are decorated with small dot-and-circle motifs. On the faces representing three and four, these motifs are arranged in groups of three, while on the other two faces they are disposed in undulating lines. There is a border of two lines at each end.

Superficially similar rectangular dice, but with a different pattern of dots on the faces, have been exacavated at Fustat and assigned to the period of the 9th to the 11th centuries.[1]

1. Contadini 1995, pp.128–9, 136–7.

110

109

111

Two lot-casting pieces
Iran, 18th or 19th century

Brass, both 6.1 × 1.1 × 1.1 cm
accession no. TLS 134

These two examples of solid brass lot-casting pieces are of rather unusual design. Each of the four faces bears a numeral from 1 to 4 in a separate compartment at the right-hand end, and four other letters and symbols whose significance is unknown. The four faces on each piece read:

gh	*q*	*l*	*h*	*1*
gh	*sh*	*n*	*ḥ*	*2*
gh	*th*	*ṣ*	⁂	*3*
gh	*ṭ*	*y*	*b*	*4*

It will be noted that in each case the left-hand element, the letter *ghayn*, is the same.

108 (top); 111 (bottom)

Astrologer's globes and a standard

by Emilie Savage-Smith

'Astrologer's globes' are a style of globe recently produced in India that has not previously been recorded in the literature. They are related to celestial globes (discussed below, see pp.168–75) but serve a quite different purpose. Though such spheres have constellation images, they are not true celestial globes, but were apparently intended as astrological compendia or *aides-mémoire*. Four examples are known, two in the Khalili Collection, cat.113 and 114, the remaining two in other private collections.[1] All four are undated and unsigned. They are inscribed in a mixture of Arabic, Persian and Urdu, the use of the latter indicating that they were made somewhere in north-central India. All are constructed of metal hemispheres, but they employ techniques and alloys that are not associated with the class of celestial globe produced in India and discussed in Part Two, Appendix 1. The iconography on these astrologers' globes is distinctive but, surprisingly, the stands associated with them are identical to those of an Indian globe with constellation figures based on a Sanskrit celestial map drawn in the early 19th century; this globe is also catalogued in Appendix 1.

A band analogous to an ecliptic is divided into segments which are labelled 0, 5, 0, 10 and so on up to 360°; the numbering runs clockwise beginning at the division between Aries and Pisces on cat.113 and between Scorpio and Sagittarius on cat.114. The numbering on both globes is incorrect and scrambled. Each segment is subdivided into four rather than five parts. A second band, similarly graduated and labelled, is placed at an angle of 50° on cat.113 and at 45° on cat.114.

The great circles at right angles to the 'ecliptic' divide the sphere into 12 gore-shaped sections in both the northern and southern hemispheres. Two such panels are assigned to each zodiacal sign, one in the northern and another in the southern half of the sphere. Each panel, beginning at the narrow point, contains material associated with that sign, such as letters of the alphabet, season of the year, part of the day or night, unlucky days of the month, the number of days the sun resides in that sign, associated temperaments, dejections and exaltations of the planets, associated lunar mansions, elements, direction of the compass, colour, sex and nocturnal or diurnal attributes.[2] The information contained in the two panels allotted to a sign is essentially identical.

All this astronomical information is written around and within engraved constellation figures. The zodiacal figures are engraved completely within the northern hemisphere, and therefore are not even approximately accurate representations of those constellations. Also represented on the northern hemisphere, in addition to the zodiacal figures, are all the classical Ptolemaic northern constellations except Corona Borealis and Lyra. Missing in the southern hemisphere are the constellations of Crater, which should be on the 'back' of Hydra, and Corona Australis. Stars are inlaid and some are numbered within the constellations. The two halves of each sphere are differently aligned with respect to the constellations: on cat.113 Orion is beneath Aquarius and on cat.114 it is beneath Gemini. The band across the upper hemisphere on cat.114 also lies in a different position to that on cat.113.

Some of the constellations are of an aberrant size – for example, Perseus – and there are also some radical deviations from conventional Islamic celestial iconography. In the southern hemisphere, Cetus the sea-monster is depicted as a large fish, Hydra as a full-fledged dragon and the Southern Fish (Piscis Austrinus) as a crocodile. Eridanus is shown not as a river but as a sash flowing from the tunic of Orion, who appears more of a dancer than a fighter. The Ship (Argo Navis) is very European in style. In traditional Islamic iconography Virgo is usually portrayed as a woman standing, her right hand lowered and, on some globes, holding an object in her left hand. However, on both cat.113 and 114 Virgo is presented as a rather elegant rendering of the common depiction of Cassiopeia sitting on a

throne, though she is not as well delineated on cat.114. Gemini is unusual on both globes in that the constellation is represented by an embracing couple, seated and viewed from behind. The constellation of Auriga is shown on both globes as a crouching man, also seen from the back, with an animal on his shoulder. Other constellations, such as Serpentarius and Orion, are also viewed from behind, and Cepheus has the open-armed stance typical of Western drawings. These images were surely drawn from some early modern European star chart or globe.[3]

The inscribed texts on these globes are a blend of medieval Islamic astrological doctrines and a very few Indian astrological elements, all presented in a mixed Urdu-Persian-Arabic vocabulary. Overlaid is an iconography representing several medieval Islamic elements, some early modern European elements and some distinctly Indian interpretations.[4]

The stands associated with the globes have no allowance for a meridian ring and clearly the globes were not intended to be used in any way like a celestial globe. The rings have a padded frame set inside them which would allow the sphere to be rapidly turned for reading without being scraped or damaged by the stand.

It seems that a now unknown workshop of globemakers in north-central India devised, probably in the late 19th century, an entirely new concept of a celestial globe – one intended to help an astrologer remember the minutiae of alignments and attributes necessary to interpret a horoscope. These globes stand in contrast to the traditional celestial globe, which was not only a model of the universe but a means of calculating the positions of houses in a horoscope, and they represent an intriguing Indian innovation in globemaking.

From a different and more recent Indian workshop comes an item that may have been used as an astrologer's standard in ceremonies or perhaps as a badge or symbol of his services, cat.112. No comparable object is recorded. Its astrological decoration implies its use by astrologers and divinators, but its precise function is unknown. Its general form is reminiscent of Indian steel maces with ribbed spherical heads.[5] At the top there is an imitation sundial, while on the sphere itself a diagram illustrates the Earth's movements about the Sun, with the solstices (21 December and 21 June) labelled in English but written in Arabic script. The 12 zodiacal signs are represented emblematically on nested circles around a crescent moon and star. It is possible that the item was intended simply as an astrologer's sign, rather like the 19th-century European show-globes that apothecaries displayed in the windows of their shops to attract customers. A notably Indian feature of the piece is the representation of the zodiacal sign Capricorn as a crocodile. In the 11th century al-Buni noted in his treatise on astrology 'that Hindus called it *magar* (mugger or crocodile) which is the name of a marine animal';[6] the survival of this tradition some nine centuries later is evident here.

1. One is in a private collection of R. Kaplan in Los Angeles: it has some additional features that do not occur on the other three examples. The other was brought into Christie's in South Kensington for examination in 1989 but was withdrawn from sale; its present location is unknown. A comparative study of these four objects will be published separately.
2. The globe in Los Angeles (see note 1, above) also has the names of angels and the Urdu names of the lunar mansions or *Nakṣatra*.
3. The constellations on these globes do not follow in detail those in the Urdu translation of al-Qazwini's *Kitāb 'Ajā'ib al-makhlūqāt* that was lithographed in 1869, even with regard to Auriga (shown frontally wearing a Roman toga and holding a goat to his chest), so that the latter could not have served as an immediate source for the designs. See al-Qazwini.
4. The Indian influence can be seen particularly in some of the figural images on the globe now in Los Angeles (see note 1, above) but they are also evident in the representation of the Southern Fish as a crocodile.
5. For an example, see Sotheby's, London, 15–16 October 1985, lot no.432.
6. al-Biruni, p.70, sec.159.

112

An astrologer's standard
India, 19th or 20th century

A brass globe 14.7 cm in diameter and a copper ring 16 cm in diameter, mounted on a thin iron rod 26 cm long and threaded for 1 cm at the base and for 4.5 cm at the top; an iron handle 25.3 cm long and 1.2 cm in diameter is screwed to the base, and a copper 'sundial' 11.3 cm high and 12.8 cm in diameter is screwed to the top; overall length 56 cm
accession no. SCI266

This composite object, which is unique in the recorded literature, was probably intended for some ceremonial or decorative purpose.

The central element is the brass sphere, which is made of two hemispheres joined using an inner soldered band. It is decorated with various designs of no particular function but probably intended to impart a notion of the heavens and the changing seasons. On one side of the sphere there is engraved the radiant disc of the Sun with a human face. This is enclosed by an ellipse around which several diagrams of the earth are shown rotating at different angles. The two points furthest from the Sun are labelled in Arabic script (but in the English language) 21 December and 21 June.

On the other side of the sphere, 12 nested but not concentric circles enclose a crescent moon and a star. Inside each of the 12 circles are personifications of the zodiacal signs, beginning with Pisces at the innermost ring. On either side of this design there are six circular medallions, each containing a personification of a zodiacal sign. To the left Aries through Virgo are represented beginning at the bottom and proceeding upwards. To the right Libra through Pisces proceed downwards. In both series of zodiacal signs the positions of Sagittarius and Capricorn are reversed. Aquarius is drawn as a water jug with a spherical body and cylindrical neck. Most distinctive, however, is the representation of Capricorn as a crocodile.

At the bottom of the sphere are four concentric rings of undeciphered writing. The metal ring around the sphere is blank.

The rod passing through the sphere and the accompanying ring is attached to the handle at one end. At the other end a rounded nut rests against the ring. A circular plate is held secure at the upper end by two hexagonal nuts. The underside of the plate is blank, while a blank triangular plate has been soldered at right angles to the upper side to form a sundial. The upper part of the circular plate has a graduated ring engraved near its outer edge, numbered 1–6 on one side of the 'gnomon' and 7–12 on the other.

113, 114

Two astrologer's globes

India, 19th or 20th century

Each globe 20.8 cm in diameter, constructed from two hemispheres of high-zinc brass joined along the 'ecliptic' by an internally soldered strip; there are engraved designs with traces of a white filler, and the stars are marked by inlaid plugs of the same alloy (SC151) or silvered plugs (SC143); each stand 14 cm high and 26.2 cm in diameter (inner diameter 21 cm), constructed of seven pieces of leaded tin brass, mostly soldered but with a brass screw securing the two semicircular under-pieces at the base; the stands lined with a brass frame wrapped with narrow strips of cotton cloth
accession nos SC143, SC151

The globes have two graduated bands, one along the seam serving as a sort of 'ecliptic' and the other at an angle of 45° (cat.113) or 50° (cat.114). The two halves of each sphere are aligned differently in each case: for example, Orion is beneath Gemini on cat.113, but beneath Aquarius on cat.114. The bands crossing the upper hemisphere also lie in different positions. Otherwise the designs are very similar. All the zodiacal constellations are engraved above the seam, as are all but two of the Ptolemaic northern constellations, some with unusual forms. In the lower hemispheres two of the southern constellations are missing. In and around the constellations are engraved rings of astrological information.

A structural difference between the two globes is that cat.113 has two short tubes inserted at the two holes bored at the 'ecliptic' poles, while cat.114 does not.

The stands, which are identical, are of a different alloy from the globe, being a very low zinc brass with considerable lead and some tin. The horizon rings are graduated in a pattern similar to the globe, but more carefully executed, with each five-degree segment subdivided into five single degrees. Each unit of five degrees is labelled in *abjad* letter-numerals, in a sequence reading 5, 10, 5, 20, 5, 30, 5, and so on up to 360, and each unit of ten degrees is also labelled with standard Arabic numerals. There is no accommodation for a meridian ring. The rest of each stand consists of two, crossed semicircular under-pieces, which are supported by four short rod-like feet. The inner edge of the horizon ring and the upper surfaces of the semicircular elements are cushioned by brass bands wrapped in cloth.

114

Mapping the Universe

Islamic celestial globes and related instruments

by Emilie Savage-Smith

The celestial globe is the oldest form of celestial mapping, for its origins can be traced to Greece in the 6th century BC. No celestial globes from antiquity have survived, if we exclude the Farnese globe which is part of a monumental sculpture and not a scientific instrument.[1] From written evidence, however, it is clear that the basic principles of their design were maintained, with modifications and elaborations, in the Islamic world, where the earliest extant celestial globes were made. There are known to be over 200 Islamic celestial globes in public and private collections, none earlier than the 11th century.[2] The Khalili Collection is not only among the largest holdings of such globes, but has one of the widest ranges, for it includes one of the oldest examples, some of the most recent, several of unique design, and others of exceptional beauty and precision. In this collection there are examples of different construction techniques as well as the major design types: globes with constellations, those with stars only, those without stars, and those with astrological imagery.

Globes with stars and constellations

On Islamic celestial globes the stars were perceived as though attached to the inside of a hollow sphere enclosing and rotating about the Earth, which was known from early classical antiquity to be spherical. Since this three-dimensional model of the skies presented the stars as if seen by an observer outside the sphere of stars, the relative positions of the stars on a medieval celestial globe are the reverse – east to west (or right to left) – of their appearance when viewed from the surface of the Earth. When the globe is viewed from above the north pole, the sequence of the zodiacal constellations is anticlockwise. This reversal can easily be demonstrated by comparing a group of constellations taken from a modern star map, showing Orion surrounded by Taurus, Eridanus, Lepus, and Canis Major with the same group of constellations as engraved on an Islamic celestial globe that is dated AH 1074 (AD 1663–4), cat.134.

On all known Islamic globes there is a set of six great circles at right angles to the ecliptic. These six ecliptic latitude-measuring circles no doubt reflect the once common use of ecliptic-based coordinates for measuring star positions. When and where this convention arose is unknown, but it contrasts with the later European convention of indicating only meridians, or circles at right angles to the equator rather than the ecliptic. Moreover, on Islamic celestial globes with constellation outlines, the human figures face outwards towards the user rather than inwards, with their backs to the observer, as was apparently the case in the Graeco-Roman and Byzantine worlds, and later in Europe. Regardless of date, the stars represented on all Islamic globes, with a single exception,[3] are those listed in the medieval star catalogues, and only the 48 constellation outlines recognized in antiquity are indicated. In addition to the celestial equator and the ecliptic, the Tropic of Cancer and the Tropic of Capricorn were frequently indicated as well as the north and south equatorial polar circles.

In addition to demonstrating celestial phenomena such as the visibility of stars at a given location, an astronomer or astrologer could use a celestial globe to determine a range of astronomical data. Like the astrolabe, the celestial globe is not a direct reading instrument, for the astronomer must manipulate and calculate the desired information, using the globe as an analogue computer for solving various astronomical and time-keeping problems.

To function as an instrument, the sphere, with its representation of the heavens, needed to be placed in an assembly with meridian and horizon rings, allowing for adjustment to a particular location.[4] Unfortunately, the rings and stands are often missing on the surviving globes, or have been replaced with modern, nonfunctioning elements. The Khalili Collection,

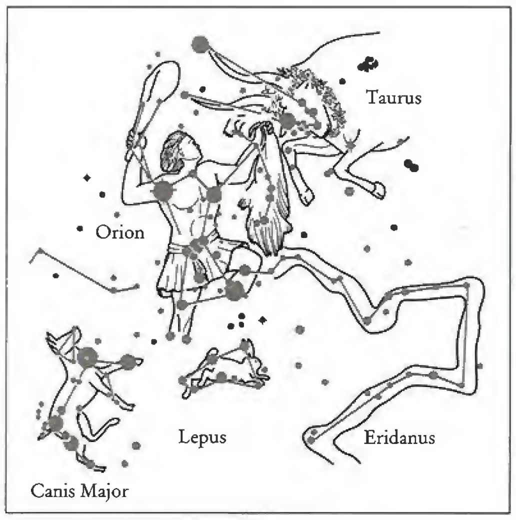


Figure 7 View of Orion and surrounding constellations as seen in the sky

134, detail showing Orion and surrounding constellations

however, includes two globes that have their original rings and stands (cat.140 and 141), and these complete assemblies allow one to demonstrate three of the numerous procedures given in the medieval treatises on the uses of celestial globes; see pp.180–185.

The oldest globe in the Khalili Collection was made in AH 684 (AD 1285–6) by an astrolabe-maker named Muhammad ibn Mahmud ibn 'Ali al-Tabari (cat.123). There are only five globes known to predate this example, the earliest being from AH 473 (AD 1080).[5] A sixth globe is contemporary with the Khalili globe, as it was made between 1278 and 1310 by Muhammad ibn Mu'ayyad al-'Urdi, the son of a well-known astronomer who made instruments for the observatory at Maraghah, about fifty miles south of Tabriz in Azerbaijan.[6]

Al-Tabari states on this globe that he positioned the stars, with a suitable increment in their longitudes, according to the *Kitāb ṣuwar al-kawākib al-thābitah* ('Book of constellations of the fixed stars') by 'Abd al-Rahman al-Sufi, a 10th-century court astronomer in Isfahan. This is the earliest known globe to state explicitly its reliance on al-Sufi's treatise as the major guide to constellation diagrams.[7] In his treatise al-Sufi had discussed each of the 48 classical constellations, giving two drawings for each constellation, one showing it as it would appear in the sky to an observer on Earth and the other as seen on a celestial globe. In addition, there was an account of the traditional Bedouin star names and asterisms with a

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115

Celestial globe
Western India or Iran

Iron alloy
diameter 11.07 cm *weight* 0.70 kg (including rod)
accession no. SCI261
published Christie's, South Kensington, London, 27 September 1990, lot no.192

The globe is seamless, and solid except for a large bore about 2 centimetres in diameter passing through the sphere. Circular plugs of an apparently different alloy, each about 2 centimetres in diameter, have been placed at either end of the bore, with a small hole drilled in each for the rod that served as an axis. The alloy is most unusual in that it seems to be predominantly iron.[1] Near the north celestial pole there are traces of a 'gilt' alloy which may reflect the use of a brass solder when inserting the plugs, and a few small traces of a silvery substance are evident elsewhere. The surface of the globe has a mottled dark brown patina with heavy overall corrosion.

No stars or constellations are indicated on the globe. The celestial equator and ecliptic are indicated by simple ungraduated lines with the names of the zodiacal houses inscribed in Arabic along the ecliptic. Six ecliptic latitude-measuring circles at right angles to the ecliptic are also indicated by engraved circles, as are the two tropic circles and the polar circles. Within each polar circle there is an additional engraved circle. Both celestial poles are labelled, and there are Arabic labels indicating the two equinoxes, the tropic circles, and the point of the winter solstice. At the celestial poles there are drilled holes. The stand and rings are missing.

It is difficult to date such a product, for no similar piece has been recorded, but it seems likely that it is 19th-century from western India or Iran.

The sphere has acquired a certain degree of magnetism which, curiously, simulates the orientation of the Earth's magnetic field.

1. Since iron is a non-homogeneous alloy, X-ray fluorescence is not a useful guide to its composition. X-rays confirmed, however, that the sphere lacks a seam.

catalogue of the stars, giving celestial latitudes, longitudes and magnitudes. Al-Sufi's star catalogue repeated, with only slight revision, that given in Ptolemy's *Almagest* for the year AD 138. Al-Sufi expressed the stellar positions in ecliptic coordinates, augmenting the longitudes given by Ptolemy by 12°42′ to correspond to the year AD 964.[8] As stated on cat.123, al-Tabari had to further increase the longitudes by five degrees to have the star positions correct for the end of the 13th century.[9] Indeed, a globe made for a given epoch would remain valid for only about three-quarters of a century.

The positions of the stars near the ecliptic on al-Tabari's globe correspond almost exactly to those on the contemporary globe by Muhammad ibn Mu'ayyad al-'Urdi.[10] However, one finds that in moving away from the ecliptic the star placements on cat.123 become increasingly unreliable, an issue discussed in more detail in the catalogue entry below.

Al-Tabari's globe is of added interest since it can be shown that it was the model for a nearly exact copy, probably made in India, which has been in the collections of the Musée du Louvre in Paris since the end of the last century.[11]

Globes with stars only

Not all celestial globes have constellation outlines on them. Constellation images are merely mnemonics enabling the viewer to visualize and remember the positions of the stars. They are not necessary for the accurate placement of stars on a globe. In fact, makers of globes – particularly more recent craftsmen – often drew the constellation outlines first and placed the stars freehand within the outlines afterwards, without employing coordinates at any stage.

Globes with stars alone are generally slightly smaller and indicate only the major or most prominent stars, which are often referred to as 'astrolabe stars' because of their occurrence on the retes, or open star maps, of astrolabes. A very fine example of the type is an unsigned Safavid globe in the Khalili Collection, cat.143. Surviving Safavid celestial globes are quite rare and, though today its rings are missing, both its metallurgical technique and calligraphy make this example one of the finest of those produced as functioning instruments.

The artistic achievements at the Safavid court are well documented, especially during the reign of Shah 'Abbas I (1587–1629), and it is tempting to suggest that this globe was made for a member of his court.

Globes with astrological imagery

A globe made for Shah 'Abbas himself in AH 1012 (AD 1603–4) represents yet another tradi-

tion of celestial globe design, for it shows only the 12 zodiacal signs, and these not as constellation outlines but as emblematic motifs inside medallions.[12] Taurus, for example, is a bull with a hump on his back and a bell round his neck, while Libra is a man sitting cross-legged with scales over his shoulders like a yoke. Although the globe does have some stars on it, they are casually positioned, and the zodiacal signs are not used as guides to the locations of stars near the ecliptic and are not derived from the illustrations of constellations found in astronomical texts. There are also two very similar globes, both unsigned and undated, with the same astrological motifs on them, with the exception of a large crescent moon that is engraved on the globe made for Shah ʿAbbas.[13] This 17th-century Iranian invention of an 'astrological' globe combining features of a celestial globe with imagery taken from astrological iconography is perhaps a forerunner of the later Indian 'astrologers' globes' that are discussed above (see pp.160–161). In general, the workmanship of the Shah ʿAbbas astrological globe appears to be inferior to that of the Khalili globe, cat.143, which is an instrument executed with considerable precision.

17th-century Mughal workshops

The most prolific Islamic globemakers of the 17th century were members of a family of instrument-makers in Lahore spanning at least four generations. During the years from 1567 to 1692, this remarkable Mughal workshop produced numerous astronomical instruments, of which 23 signed globes include ones with constellation images as well as those with stars only. Although there are several astrolabes by this family in the Khalili Collection, there is as yet no globe.[14] The earliest of their globes dates from the 18th year of the reign of Jahangir, that is 1622–23, and the last from AH 1090 (AD 1679–80),[15] by which date they had apparently moved their workshop to Delhi.[16]

All of the globes produced by this family were seamless hollow spheres cast by the *cire*

Hajji Mirza Aghasi presents Muhammad Shah Qajar with a globe, from a pair of lacquer book covers, Isfahan, AH 1262 (AD 1845–6); 26.9 × 19.9 cm. Khalili Collection, LAQ29

perdue (lost wax) process, rather than constructed from two metal hemispheres. Present evidence suggests that the technique of casting seamless globes originated in north-western India towards the end of the 16th century, the earliest confirmed date being AH 998 (AD 1589–90) on a globe produced by ʿAli Kashmiri ibn Luqman.[17] The production of seamless globes became a speciality of the 17th-century Lahore workshop, but continued to be practised in India after this family had ceased to make them. That the family did not, even in the 17th century, have a monopoly on this demanding technique is demonstrated by an outstanding celestial globe, cat.134, which was made in India in AH 1074 (AD 1663–4) by Muhammad Salih Tatawi.[18]

18th- and 19th-century workshops

If constructing globes in the form of a seamless, cast sphere is typical of northern Indian globemaking, it is interesting that it was used to produce a globe in AH 1212 (AD 1797), perhaps in Iran (cat.151). It is possible that its maker, Muhammad Sharif ibn Muhammad Riza, was a Persian artisan who had emigrated for a while to India and learned the local metalworking techniques. He was probably the son of the chief astronomer, Muhammad Riza, of the Qajar ruler Fath ʿAli Shah. The instrument was made in the year that Fath ʿAli Shah acceded to the Qajar throne and with its unusual design, carefully and attractively executed, it would have been an appropriate accession gift. A lacquer painting in the Khalili Collection, LAQ 29, shows a similar gift of a globe being presented to Fath ʿAli Shah's successor, Muhammad Shah Qajar.

Not all globes made in India were produced by casting a seamless sphere, as cat.138, which is made of two hemispheres joined along the equator by an internally soldered strip, demonstrates.[19] It is dated AH 1257 (AD 1841–2), and from the signatory inscription it appears that the maker, Muhammad Naʿim al-Din Muradabadi, copied an earlier globe. As the star positions on Muradabadi's globe correspond roughly to those on Indian 17th-century globes, such as those from the Lahore workshop, the model may have been of 17th-century date. On the other hand, the stars are not placed with consistent precision, so it may be unwise to extrapolate from such details. Another Indian globe, made after AD 1806, was apparently also derived from the same model, and, like Muradabadi's, was made from two hemispheres. Nevertheless, it cannot be presumed that the model, however similar in design, was identical in its method of construction.[20]

Three years after making the globe, Muhammad Naʿim al-Din Muradabadi presented it to Muhammad Amjad ʿAli Shah, who had acceded to the title of Nawab of Oudh in 1842.[21] The capital of the Nawabs of Oudh was at Lucknow, which suggests that Muradabadi's workshop may also have been there.

Muradabadi's activities were contemporaneous with those of the busy workshop of a Hindu metalworker named Lalah Balhumal Lahuri, which produced several works for both Indian and British patrons in the Lahore region in the 1840s. Not only was this workshop sited in Lahore, but it represents the continuation of the instrument-making tradition established there in the 16th and 17th centuries, and indeed all the globes it produced employed the *cire perdue* technique of casting seamless spheres which is associated with the earlier Lahore products. The products of the Balhumal workshop are precise instruments, easily identifiable by their workmanship and several distinctive features.

Among the objects that can be attributed to his workshop are a celestial globe with captions in *devanāgari* characters, and two globes in the Khalili Collection, cat.140 and 141.[22] The former was made for, or at least later owned by, a Hindu astronomer or astrologer

(*jotishī*) named Daharamchand. It has the 48 classical constellations with captions in Arabic. The second globe is unusual in that all the inscriptions are in English, implying that Balhumal made this instrument for an English-speaking patron. Despite this feature, it is completely within the tradition of Islamic celestial globemaking.

European influences

European contacts and influence in the scientific realm increased throughout the 18th century. For example, an astronomer named Muhammad Sharif was sent to Europe, apparently about 1730, by Sawai Jai Singh II (d. 1743) from his court at Delhi to search for European instruments and astronomical tables.[23] There were ample opportunities in both India and Iran for astronomers and instrument-makers to learn of European innovations,[24] and it is evident, for example, that by the early 19th century early modern European mappings of non-Ptolemaic constellations were employed by some Indian globemakers.[25]

Globes without stars

Not all Islamic celestial globes had stars on them. There are a number, usually rather small in size, that have only some of the great and lesser circles. The type is not mentioned in any of the treatises dealing with celestial globes, and it is difficult to establish a date and provenance for it. The majority of examples are made with seams, but there are also a considerable number that appear to be seamless, although in most instances confirmation has yet to be obtained by X-ray. In general, it would seem that the type was of Persian origin of the late 17th or early 18th century, but that examples were also produced in India. Few are signed or dated, the only two known dated specimens both coming from the first quarter of the 19th century.[26]

Cat. 115 is a celestial globe that has no representations of stars. This example is unusual, however, in that it appears to be made of iron. The sphere has acquired a certain degree of magnetism which, curiously, simulates the orientation of the Earth's magnetic field. Such a property brings to mind the small *terellae* that were popular in 17th- and 18th-century Europe. These spherical lodestones reproduced in miniature the magnetic system of the earth, for which reason they gained the name *terella* or 'little Earth'. Such natural magnets were polished and engraved with lines representing the ecliptic, equator, the tropics and polar circles, and sometimes lines of 'longitude' and 'latitude'. On such a *terella*, a fine needle would not only align itself with the direction of north, but would also 'dip' to indicate the magnetic equator.

While it is tempting to speculate that cat. 115 may have been a *terella*, the degree of magnetism does not seem great enough to have permitted the sphere to function as such, and it is more likely that the magnetism was accidentally acquired. Moreover, its size is considerably greater than any recorded *terella*.[27]

Conclusion

The method of construction can sometimes provide important evidence for differentiating workshops. Available evidence suggests that seamless metal globes are Indian products, while globes made in hemispheres could have been produced in any region and at any period. Clearly the largest and most expensive celestial globes were those that had the full complement of stars as well as the constellation outlines, and the earliest preserved examples are of this form. To function fully, however, a globe did not need to have the constellation outlines but only required a reasonable selection of major stars and to be executed with

precision. Early astronomers do indeed refer to globes bearing only the major stars, and one globe that had stars alone was apparently made in the middle of the 12th century.[28] Nevertheless, most of the globes preserved today of this design were produced in the 15th century and later, and all appear to have been made in Iran or India.

The globes that lack even stars, but have only the celestial circles indicated on them, are of more limited use than the other two designs. They served primarily as didactic devices to demonstrate basic celestial phenomena, such as the equality of day and night for any geographical location when the sun is at one of the equinoxes. Starless globes are not mentioned in the medieval literature concerned with astronomical instruments, and available evidence suggests that they are quite a late, probably 17th-century, Iranian or Indian development in design. Astrological globes, both those of Safavid Iran with emblematic representations of zodiacal signs and the Indian astrologers' globes discussed above, are not true celestial globes and served a different purpose. The influence of early modern European celestial cartography began to be felt in India and Iran from the 18th century, but is particularly evident in the 19th century. It is also evident in a group of globes (see Appendix 1), some of which are clearly recent fakes with dates and names added to deceive the buyer.[29]

1. The marble sphere, 65 centimetres in diameter, is held by a kneeling figure of Atlas. The date of the sculpture, now in the Museo Nazionale, Naples, is uncertain, and estimates range from the 4th century BC to a 1st-century AD copy. See Valerio 1987, who argues that it is a 1st-century BC original; see also Savage-Smith 1985, pp.11 and 16.
2. This total includes those now in the Khalili Collection as well as an additional 54 that were not known when the history and catalogue of celestial globes was prepared by Savage-Smith (1985); see also Savage-Smith 1990 and Savage-Smith 1992a.
3. A globe made in AH 1223 (AD 1808–9) by Muhammad Fadlallah ibn Muhammad Murad ibn Muhammad Musa Asturlabi, which has *Canes Venatici* visible on the one available photograph; Hyderabad, The Salar Jung Museum, acc.no. 112/xxxv.
4. For further information on the design of Islamic celestial globes and ring assemblies, see Savage-Smith 1985, pp.61–95.
5. Florence, Istituto e Museo di Storia della Scienza, inv. no. 2712, dated 1 Safar AH 473, or 478; Paris, Institut du Monde arabe, Destombes Collection, made in AH 539 (AD 1144–5) by Yunus ibn al-Husayn al-Asturlabi; Naples, Museo Nazionale, made in AH 622 (AD 1225–6) by Qaysar ibn Abi'l-Qasim ibn Musafir al-Ashrafi al-Hanafi; London, British Museum, Department of Oriental Antiquties, inv. no. 71.3.1, made in AH 674 (AD 1275–6) by Muhammad ibn Hilal al-Munajjim al-Mawsili; and Paris, Bibliothèque Nationale, Département des Cartes et Plans, inv. no. GE.A.325, undated but with an estimated date of AD 1080. See Savage-Smith 1985, pp.217–20, nos 1–5 and p.236, no.34.
6. Dresden, Staatlicher mathematisch-physikalischer Salon; see Savage-Smith 1985, p.220, no.5. An unsigned globe of very similar design is in Paris, Institut du Monde arabe, Destombes Collection; see Savage-Smith 1985, p.236, no.35.
7. Wellesz 1959; 1964; Kunitzsch 1986; and Savage-Smith 1992a pp.50–60.
8. The epoch of al-Sufi's catalogue is the beginning of the year 1276 of the Alexandrian era, which corresponds to 1 October 964.
9. It would seem that al-Tabari employed a value of 1° per 66 years, as al-Sufi had earlier in his catalogue, for the precession of the equinoxes, and that al-Tabari must have intended the epoch of his globe to be about AD 1300.
10. See above, note 6.
11. Paris, Musée du Louvre, Section Islamique, inv. no.6013; see Savage-Smith 1985, pp.220–21 no.6 and pp.27–9 and fig.6. A detailed comparison of the Louvre globe and the one now in the Khalili Collection will be published separately.
12. Chicago, The Adler Planetarium, inv. no. A.114; see Savage-Smith 1985, pp.249–50, no.63, and p.47, fig.20. The globe is unsigned, but has the date and patron's name, *Bandah-yi Shāh-i Vilāyat ʿAbbās* 'slave of the Shah of Sanctity, 'Abbas' [Shah 'Abbas I] engraved in a cartouche. A unique feature of this globe is a large crescent moon engraved on it between the north celestial pole and the House of Aries.
13. Greenwich, National Maritime Museum, inv.no. G.142.NA 9022-40C, and Cambridge, Whipple Museum of the History of Science, inv.no.1410; see Savage-Smith 1985, p.259, nos 82 and 83.
14. See p.219.
15. The earliest was made by Qa'im Muhammad ibn 'Isa ibn Allahdad Asturlabi Lahuri Humayuni, of the third generation, for a certain Navab I'tiqad Khan; now in the library of Stonyhurst College near Blackburn, Lancashire, see Savage-Smith 1985, p.224, no.11 and illustrations on pp.37–8, figs 12 and 13 and p.103, fig.37. The most recent dated globe, which is actually a variant form of celestial globe from this workshop, was made by his son, Diya' al-Din

Muhammad, and is now in Rockford, Illinois, The Time Museum, inv. no. 3406, see Savage-Smith 1985, p.232, no.30; Savage-Smith 1992a, p.51, fig.2.23. For a survey of globes made by this family, see Savage-Smith 1985, pp.34–43; since that publication, two additional globes have come to light: one made in AH 1074 (AD 1663–4) by Diya' al-Din Muhammad, and one dated AH 1094 (AD 1682–3) made by his cousin Hamid, both of which are now in the Salar Jung Museum in Hyderabad. Information on them was kindly supplied by S.R. Sarma.
16. Savage-Smith 1985, pp.42–3.
17. London, private collection; see Savage-Smith 1985, pp.223–4, no. 10 and illustration on p.35, fig.11 and p.176, fig.69. Nothing further is known of this maker.
18. For a full discussion see the relevant catalogue entry below.
19. This globe, and all the globes in the Khalili Collection, have been x-rayed so as to confirm their basic method of construction.
20. The maker, Ghulam Husayn ibn Fath Muhammad al-Karbala'i al-Jawnpuri, stated on the globe that 'the stars were positioned with longtitudes and latitudes that were observed with the astrolabe and other [instruments] on 7 Ramadan 1221 [28 November 1806].' The globe is now in a private collection in Aligarh. This information is based on photographs generously supplied by S.R. Sarma. Jawnpuri is also known as an author of several astronomical and mathematical treatises, including one completed in AH 1249 (AD 1833–4); see Storey 1972, pp.19–20, and p.99.
21. Philips 1951, p.92.
22. For further details, see pp.242–3.
23. Pingree 1987b, pp.315–17.
24. See Blanpied 1974, pp.117–24; Ansari 1992. Earlier contacts in the 16th and 17th centuries with European celestial cartography did not have much lasting impact. For example, the planispheric star maps based on the early modern European star maps printed about 1650 by Melchior Tavernier and engraved in AH 1065 (AD 1654–5) on astrolabe plates by instrument-maker Muhammad Mahdi of Yazd (see cat.144) seem to have had no further influence upon Islamic celestial cartography or instrument design; see Savage-Smith 1992a, pp.65–8. Similarly, the magnificent gilt-metal celestial globe produced in 1579 in the workshop of Gerard Mercator and presented to Sultan Murad III (*reg.*1574–1595), appears to have had no subsequent influence upon celestial globe design in the Ottoman empire or elsewhere in the Islamic world; see the special catalogue published by Christie's London, *The Murad III Globes*, to accompany the sale held on 30 October 1991.
25. A globe now in Hyderabad, the Salar Jung Museum, acc.no. 112/XXXV, was made in AH 1223 (AD 1808–9) by Muhammad Fadlallah ibn Muhammad Murad ibn Muhammad Musa Asturlabi and depicts, for example, at least one non-Ptolemaic northern constellation, the two dogs on a leash held by Boötes (*Canes Venatici*), one of the nine constellations mapped by the Danish astronomer Helevius (d. 1687). The globe's method of construction is unknown. It is inscribed in Arabic and Persian and states that the star positions were marked according to the coordinates given in the *Zīj-i Niẓāmī* of Khwajah Bahadur Husayn Khan. (For the latter figure, see Storey 1972, p.100.) The nature of the inscription was kindly supplied by S.R. Sarma in a private communication, as was a photograph of the instrument. The inscription itself has not been examined. Sarma states that Muhammad Fadlallah is the only globe-maker known to have been active in South India. The stand holding the globe, with a magnetic compass in the base, points to European influence, while the manner in which the constellation Virgo is rendered suggests that the globe was influenced by the same source which served as a model for two planispheric star maps that occur in a Sanskrit manuscript, *Sarvasiddhāntatattvacūḍāmaṅi* ('Jewel of the Essence of all Sciences') written sometime before 1839 by Durgashankara Pathaka, an astronomer of Benares. The Sanskrit maps are clearly close renderings of a European model presenting the new non-Ptolemaic constellations, with the faces of the human figures drawn in the style of late provincial Mughal artists. See London, British Library, MS.Or. 5259, folios 59r and 60r; for details and reproductions, see Losty 1982, pp.194–5; Savage-Smith 1992a, pl.2 and p.70, fig.2.51.
26. Savage-Smith 1985, pp.263–75.
27. An 18th-century English *terella*, 5.5 centimetres in diameter, is now in Oxford, Museum of the History of Science, inv. no.57-84/271 Billmeir Collection. For one 4.2 centimetres in diameter, mounted in a 17th-century French ivory globe stand with meridian ring, see the catalogue of a sale at Drouot, Paris, 28 April 1982, lot no.148.
28. Tehran, Museum of Ancient Iran; see Savage-Smith 1985, p.247, no.59.
29. The recent copies are probably made by the same workshop that David King refers to in connection with fake astrolabes and monumental Islamic armillary spheres when he speaks of 'one of my favorite schools of fakers is in Delhi'; see King 1995a, p.11.

116

Two fragments from the *Almagest* of Ptolemy

Spain or North Africa,
11th or 12th century

8 folios, 17.9 × 24.2 cm (best-preserved folios); text area 11.9 × 17.4 cm, with 16 to 17 lines per page, written in *maghribī*, without catchwords, in brown, red, green and purple ink on vellum
accession no. MSS 375

These eight vellum folios consist of two fragments from an Arabic translation of the most influential astronomical treatise prior to the time of Copernicus, the *Almagest*, which was written in Greek in the 2nd century AD by the Alexandrian astronomer Ptolemy. It was from its Arabic title, *al-Majisṭī*, that Ptolemy's work received the name by which it is generally known today. Four Arabic versions of the treatise were prepared in the 9th century, though only two are extant: that by al-Hajjaj, completed in AH 212 (AD 827–8), and that by Ishaq ibn Hunayn and later revised by Thabit ibn Qurrah in AH 288 (AD 901).[1] The fragments in the Khalili Collection are from the second version, for they correspond, with minor variant readings, to passages in a manuscript preserved now in the British Library, one of only two recorded copies of the second half of that Arabic version.[2]

On folio 2a it is stated that the text is from the sixth chapter (*jumlah*) on the demonstration of the size of the epicycle of the planet Saturn; this is immediately followed by a reference to an observation made on the sixth and seventh days of the month of Mechir in the Egyptian Calendar (22 and 23 December 138) during the first year of the reign of the Roman emperor Antoninus Pius (*reg.* AD 138–161).[3] This heading and text precisely corresponds to the opening of the sixth chapter of the eleventh book of the *Almagest*.

The eight folios form two pairs of two bifolios. The first pair (folios 1–4) are from the centre of a quire, as they present a continuous text from Book Eleven of the *Almagest*, beginning at the end of the fifth chapter and continuing with most of the sixth chapter, which is concerned with the determination of the size of Saturn's epicycle.[4]

The second pair (folios 5–8) are, to judge from the length of the missing text, the two outer bifolios of an 8-folio quire. Consequently, two bifolios of text are missing between folio 6b and folio 7a. The text for the entire section is on the computation of the 'slant' of Mercury and Venus from Book Thirteen of the *Almagest*, section five, according to the Arabic version.[5]

It is difficult to date these fragments precisely, but it seems likely that they are from the 11th or 12th century.[6] The place of production is equally elusive. The placement of diacritical dots on the letters is typical of *maghribī* script, though the descending curves of the letters are less pronounced than usual, the verticals are very straight and not obviously ornamented with serifs, and *dāl* and *dhāl* are written in the plainer fashion of a *naskh* script. There is occasional vocalization, and the undotted letters such as *ḥā'* or *'ayn* sometimes have minuscule letters written under them. The latter is a feature typical of carefully produced early manuscripts.

No comparative study of Andalusian and North African forms of *maghribī* script has been published, nor has there been an attempt to trace chronologically the development of differing forms of *maghribī*.[7] An undated fragment of a Maghribi manuscript with a rather similar script, now at the University of Leiden, is thought to be of 10th- or 11th-century date and of Andalusian origin.[8] A manuscript with similar script, now in Paris, was copied in AH 562 (AD 1166–7), possibly in Seville.[9] Another feature arguing for an Andalusian origin for cat.116 is the fact that there is some evidence to suggest that in *andalusī* script dots were methodically placed on the final *qāf* and *nūn*, whereas in *maghribī* script these points were often omitted.[10] On the other hand, a vellum manuscript definitely copied in Andalusia in AH 472 (AD 1080) has the very curved and hooked ascending and descending strokes generally associated with *maghribī* script, but lacking in the Khalili fragments.[11] Consequently, available evidence suggests that a very curved and hooked *maghribī* script could occur in Spain as well as across North Africa from at least the 11th century AD, but whether the plainer version was restricted only to Andalusia is uncertain.

Since only two complete manuscript copies appear to have been preserved of the 11th and 13th books of the *Almagest* in the Ishaq/Thabit translation, these vellum fragments are of great significance.[12] Furthermore, the diagrams in these fragments appear more carefully drawn than those in the 13th-century copy available for comparison. Since these vellum fragments are clearly a western product of about the 12th century, perhaps made in Spain, the possibility arises that these fragments may represent the version of Ptolemy available to the translators and compilers who prepared the *Libro del saber de astrología* for Alfonso el Sabio ('The Wise'), crowned Alfonso X of Castile in 1251.

116, detail of folio 2a

116, detail of folio 5a

116, detail of folio 8b

1. See Kunitzsch 1974, pp.37–45; Sezgin 1978, pp.88–94.
2. British Library, MS.Add.7475, dated Sha'ban 615 (October 1218), contains the last seven books of the *Almagest* in the translation by Ishaq and Thabit. MS.Add.7474 contains the first six books, completed, according to the colophon at the end of the fourth book, in AH 686 (AD 1287–8). No complete edition of either Arabic version has been published. Kunitzsch (1974) compares the two for many section headings, but omits Book Eleven.
3. For the Egyptian calendar employed by Ptolemy, see Ptolemy–Toomer, p.9; for dated observations in the *Almagest*, see Pedersen 1974, pp.408–22.
4. Folios 1a–4b of cat.116 correspond to folios 145a, line 2–148a, line 2 in British Library MS.Add.7475. For an English translation, see Ptolemy–Toomer, pp.537–40.
5. This is section four in the English translation; see Ptolemy–Toomer, pp.625–31. Folios 5a–6b of cat.116 correspond to folios 215b, line 14–217a, line 11 in British Library MS.Add.7475. Folios 7a–8b of cat.116 correspond to folio 221b, line 17–folio 223a, line 9 of the British Library text.
6. The most recent dated parchment manuscript with *maghribī* script is from the year AH 498 (AD 1105); see Khoury & Witkam 1993–, p.408.
7. The study by Boogert (1989) is limited to 19th- and 20th-century North-African specimens.
8. University of Leiden, MS.OR.14.039, illustrated and described by Witkam (1983–9, fasc. 1, pp. 66–7). The verticals are not as straight or pronounced as in cat.116, however, and the vertical stroke of the *tā'* is not as oblique.
9. Paris, Bibliothèque Nationale, MS.arabe 6499 copied by 'Ali ibn Haruf; see Déroche *et al.* 1992–, fiche no.65. From the same period is a manuscript combining many features of *maghribī* script with others characteristic of *naskh*, completed by 'Abd Allah ibn 'Abd al-Rahman ibn Ahmad ibn Juzayy al-Andalusi al-Balansi in AH 562 (AD 1167) (Paris, Bibliothèque Nationale, MS.arabe 2086; see Déroche *et al.* 1992–, fiche no.39).
10. James 1992, p.216.
11. Paris, Bibliothèque Nationale, MS.arabe 6090, completed by Ahmad ibn 'Ubayd Allah on 1 Sha'ban 472 (27 January 1080); see Déroche *et al.* 1992–, fiche no. 68.
12. The two copies are the British Library manuscript cited earlier and a copy of all 13 books of the treatise in a manuscript in Tunis, Bibliothèque Nationale, MS.07116; see Kunitzsch 1974, pp.38–42.

116, folio 1a

117

An illustrated star catalogue

Iran, 15th or 16th century

32 folios, 25 × 18 cm, of a burnished, cream paper with visible laid lines; folio 1a bears a description of the contents written in *riqāʿ* in black ink; folios 1b–32a have a red frame, 18.5 × 12.5 cm; headings in green *riqāʿ*, which has often darkened to a greenish black; tables of seven columns of varying widths, framed in red and containing text in *nastaʿlīq*, in black and red; star diagrams in black outline, with the stars identified in red; folio 13b is blank except for the frame, and folio 32b is blank
accession no. MSS 975

This undated and anonymous Persian manuscript contains a tabulated star catalogue derived from one source, illustrated with star diagrams from another. The tables were drawn from *al-Zīj al-sulṭānī*, an important compilation of astronomical data produced at the Samarqand observatory between 1420 and 1438, under the patronage of the Timurid ruler Ulughbeg ibn Shahrukh.[1] The relationship of cat.117 with the *Zīj* is made clear by the title on folio 1b, which reads, 'Table showing the positions of the fixed stars in terms of longitude and latitude, as we observed them at the beginning of the year 841 of the Hijra', that is, AD 1437–8. The same text, and the tables that follow, appear at the end of the third chapter (*maqālah*) of the *Zīj*.

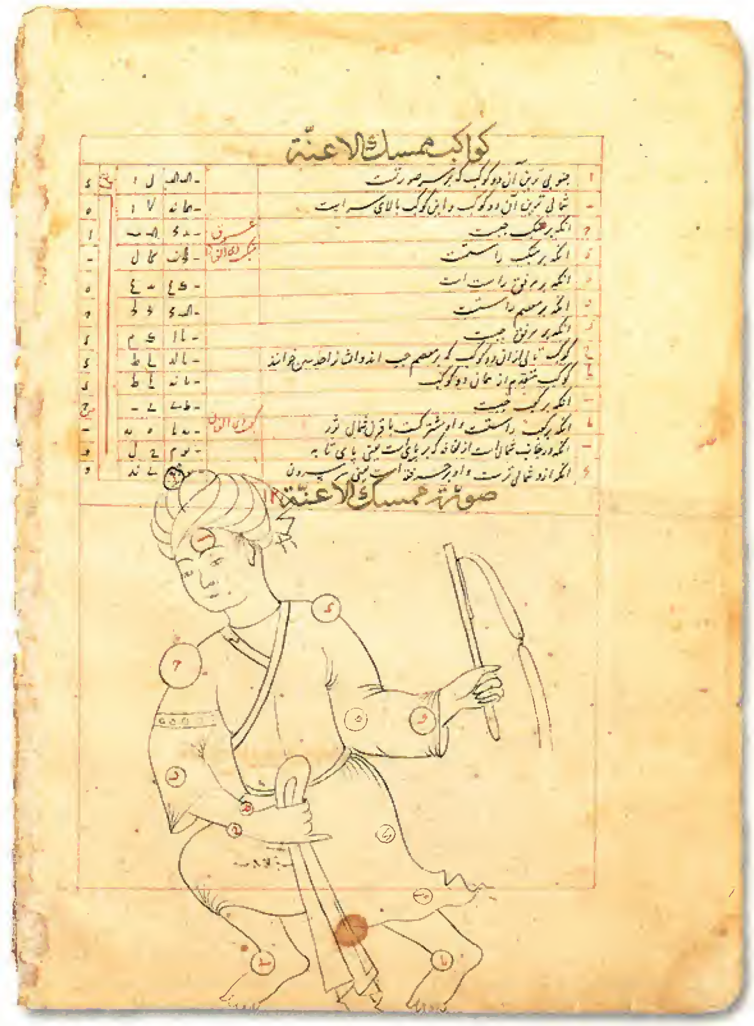
Each table covers the stars in one constellation, and each star is identified by a number, given as a red *abjad* numeral in the right-hand column. The remaining six columns contain a description of the star's position; the name by which it was commonly known, if there was one; the longitude, the latitude, and the *jihat* ('direction'), that is, an indication of whether the star lay north or south of the ecliptic; and finally the magnitude of the star on a scale of one to six, according to the 10th-century star catalogue of Abd al-Rahman al-Sufi.

This latter treatise, known as the *Kitāb al-ṣuwar al-kawākib al-thābitah* ('Book of the constellations of fixed stars'),[2] was also the source of the constellation diagrams that follow each table. In the original, al-Sufi provided two drawings of each of the 48 constellations he discussed, one showing the constellation as it would appear in the sky, the other as it would be seen on a celestial globe. In cat.117, however, only one view of each constellation is presented – usually, but not always, the second. The diagrams were drawn with great care and follow a very traditional format, but they do not appear to have been copied directly from any of the published copies of al-Sufi's treatise.

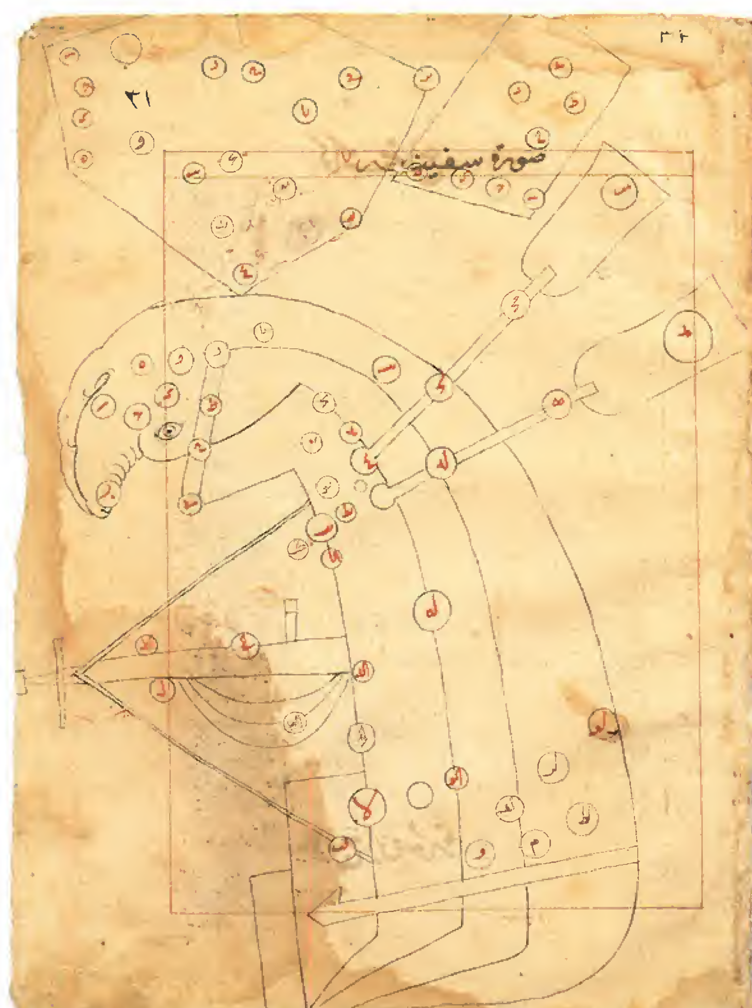
A number of single leaves are missing from the manuscript, and with them the diagrams for Draco, Triangulum, Aries, Gemini, Cancer and Scorpio. The text ends abruptly after the illustration of Pisces Austrinus.

Folio 1a has six lines of text describing the contents: 'the stars observed are amongst the fixed stars which Ptolemy reckoned in the *Almagest*, and the six related magnitudes, the largest being the first magnitude and the smallest the sixth. For the sake of learning about these stars, there are 48 illustrations incorporating the 1022 stars – on the north side of the zodiac 21 [constellations], in the zodiac 12, and on the south side of the zodiac 15. Some of these fixed stars are in the constellations themselves, and some are in the peripheral areas of the constellations which are interpreted as being outside the constellation.' The same folio also bear's an owner's seal, now defaced.

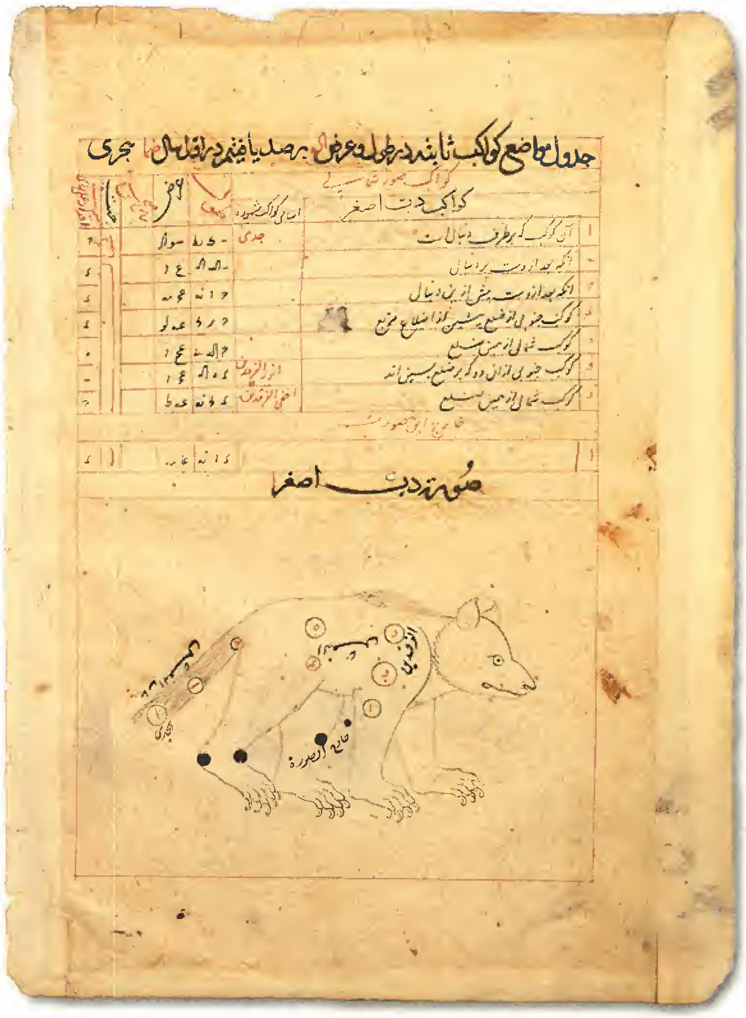
1. Storey 1972, pp.67–72; King 1986a p.157, no.G49. In the copy of the *Zīj al-sulṭānī* in the Bodleian Library, Oxford, MS.Greaves 5, the corresponding star catalogue occurs on folios 162b–181b. See Knobel 1917.
2. Storey 1972, pp.41–2; King 1986a, p.41, no.B52.



117, folio 8b, showing Auriga as seen on a globe

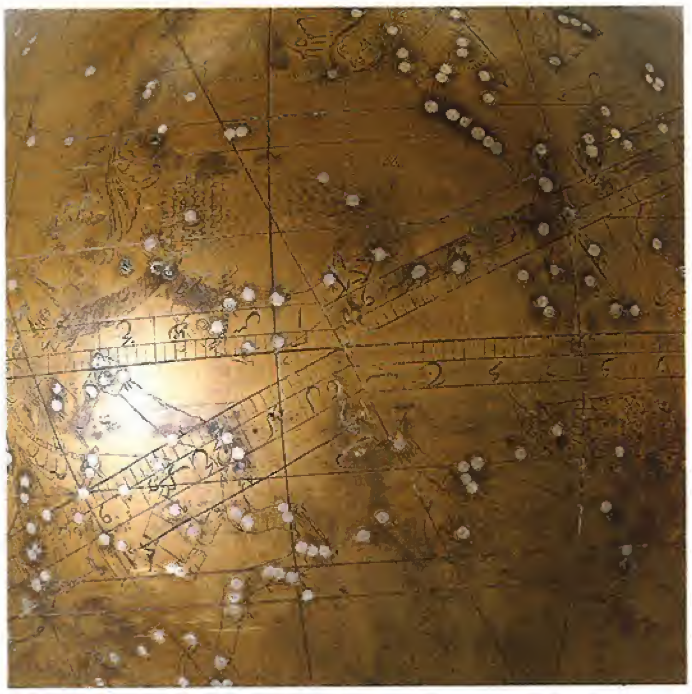


117, folio 27a, showing Argo Navis as seen in the sky

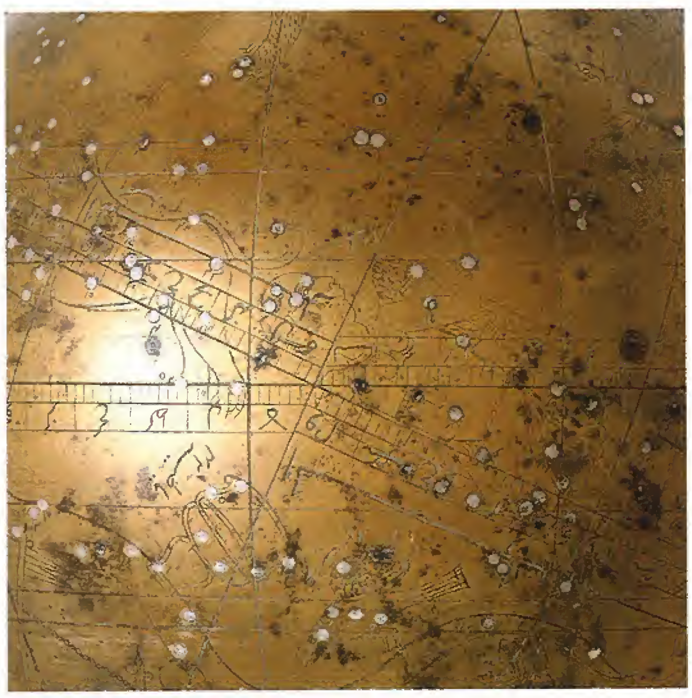
117, folio 8a, showing Perseus as seen on a globe

117, folio 1b, showing Ursa Minor as seen on a globe

117, folio 23a, showing Orion as seen on a globe

117, folio 20a, showing Aquarius as seen in the sky



140, detail showing vernal equinox, with North at the top



140, detail showing autumnal equinox, with North at the top

Celestial globes and their uses

To function as an instrument, a celestial globe must be placed in a ring assembly, allowing for its adjustment to a particular location. The horizontal ring, supported by a stand, defines the horizon. The meridian ring indicates the north – south points and the celestial poles, while the zenith ring, which is at right-angles to the meridian ring, marks the East – West points and the point directly overhead. The sphere itself bears the celestial equator, the ecliptic, the Tropics, and the great circles passing through the ecliptic poles (the ecliptic latitude-measuring circles).

Arabic treatises on celestial globes present numerous procedures for their use. Three examples will be given here, demonstrating the use of a celestial globe to find the length of an unequal hour on a given day, to calculate the passage of time, and to determine the houses of a horoscope.[1] In the illustrations of these functions that follow, the zenith ring has been removed from cat.140, which still has its original rings and stand.

Islamic civil and religious time-keeping was based on the unequal hour. This unit was calculated by dividing the period between sunset and sunrise and the period between sunrise and sunset by twelve, the result being affected by three factors. Firstly, night and day are only of equal length on two occasions, at the spring and autumn equinoxes, and night-time and day-time hours are therefore unequal on the other 352 or 353 days of the Muslim year. Secondly, night and day lengthen or shorten as the seasons progress, so that unequal hours vary from one day to the next. Thirdly, the progress of the seasons varies from one latitude to another, so that unequal hours vary from place to place. For these reasons the precise length of an hour at a given place on a given day had to be obtained by an individual calculation, for which a celestial globe could be used.

140, detail from above, showing the meridian and horizon rings

140, showing parts of a celestial globe

1

2

3

Calculating the length of an unequal hour

Knowing the geographical latitude of a town, say, Lahore, which lies at 32° north, rectify the globe – that is, raise the northern celestial pole 32 degrees above the horizon ring (see 4, below).

1 Find out from a calendar where the Sun is located in the ecliptic for that day, say 8° in the House of Gemini, and align that point with the eastern horizon. Mark the point on the equator now at the eastern horizon (A).

2 Align the degree of the Sun on the ecliptic with the western horizon.

3 Mark the point on the equator now at the eastern horizon (B).

The angular distance between A and B, 220°, represents the amount of daylight on the day in question, each degree being equivalent to 4 minutes of time. To calculate the length of the day-time hour, divide the angular distance by 12, giving 18° for each hour, with a remainder of 4; multiply the number of degrees by four, giving 72 minutes; and multiply the remainder by five, giving 20 seconds. A day-time hour is therefore equivalent to 72 minutes and 20 seconds on that day.

The complement of the distance between A and B is 140°, which represents the time between sunset and sunrise. By the same procedure the length of a night-time hour on that day may be calculated as 44 minutes and 30 seconds.

4

1

2

3

4

5

Telling the time
To determine how much time has passed since sunrise, a celestial globe can be used as a spherical elevation or altitude dial:

1 Rectify the globe (see p.182). Align the north point of the horizon ring with the direction of north at that location – the local meridian line. Learning from a calendar the position of the Sun along the ecliptic for that day, for example, 8° Gemini, attach a pin at that point. In sunlight, rotate the sphere until the shadow is as short as possible. The altitude of the Sun is represented by the position of the pin relative to the horizon rim. The Ascendant is then the division of the ecliptic that is at the eastern horizon ring.

2 Should the local direction of North be unknown, and if the meridian ring has a sliding sleeve with a hole in it, another method can be employed. With the globe assembly placed on a level surface, lower the north pole onto the north point of the horizon ring. The assembly is moved until the meridian ring casts no shadow to either side of the ring. The globe will then be oriented along the local meridian line. After placing a pin or gnomon in the sliding sleeve, the sleeve is then moved along the ring until the pin casts no shadow. The altitude of the gnomon can be read from the meridian ring, and is equivalent to the altitude of the Sun.

2, 3 After rectifying the globe, the position of the Sun, for example, 8° Gemini, can be determined with respect to the horizon ring by transferring the angular distance read on the meridian ring to the position of the Sun in the ecliptic using a pair of drawing compasses and marking it off along an arc passing through the zenith.[2] The Ascendant will be at the eastern horizon. Having determined the Ascendant, mark the division of the equator that is at the eastern horizon (C).

4 Rotate the sphere eastwards until the Sun is at the eastern horizon ring. Then mark the division of the equator which has reached the horizon (D).

5 Count the degrees between C and D. For the elapsed time in unequal hours, multiply by four to convert the time into minutes and then divide the result by the length of the unequal hour for that day as previously determined.

For example, if the Sun at 8° Gemini were at an elevation of 71°, then the angular distance between the two markers would be 84°, giving the elapsed daytime in unequal hours as 4 hours and 40 minutes, when the unequal daytime hour had earlier been determined to be 72 minutes and 20 seconds in length.

To determine the houses of a horoscope
Of interest to astrologers was the possibility of casting a horoscope without complex calculations. Given the altitude of the Sun at a given location, as described in the previous example, or the altitude of a certain star obtained by using an astrolabe, and given the length of the unequal hours on that day, a horoscope could be easily constructed in the following manner:[3]

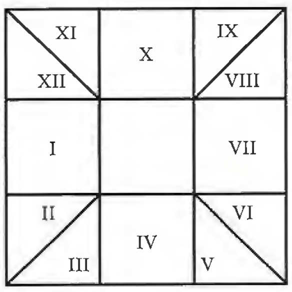
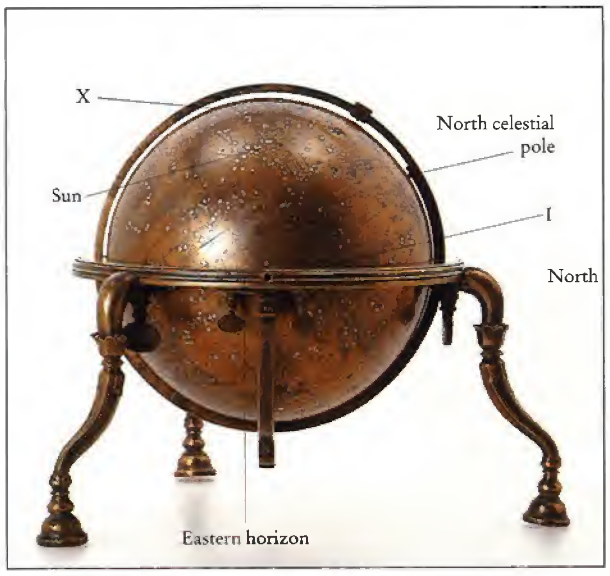
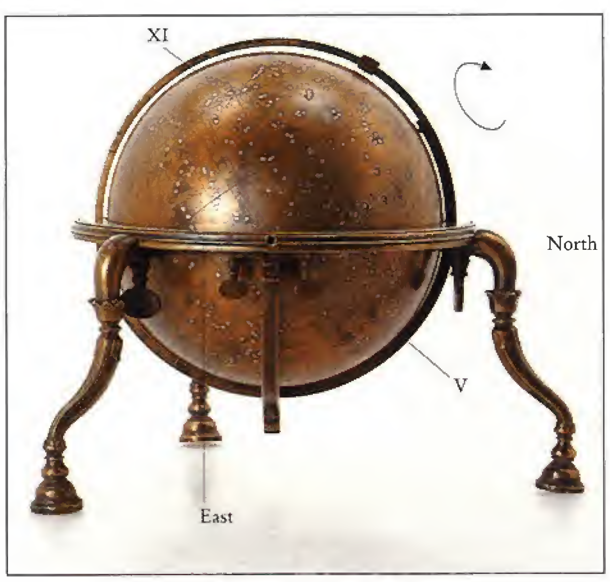


Figure 8 Horoscope map, showing the 12 Houses (*Loci*)

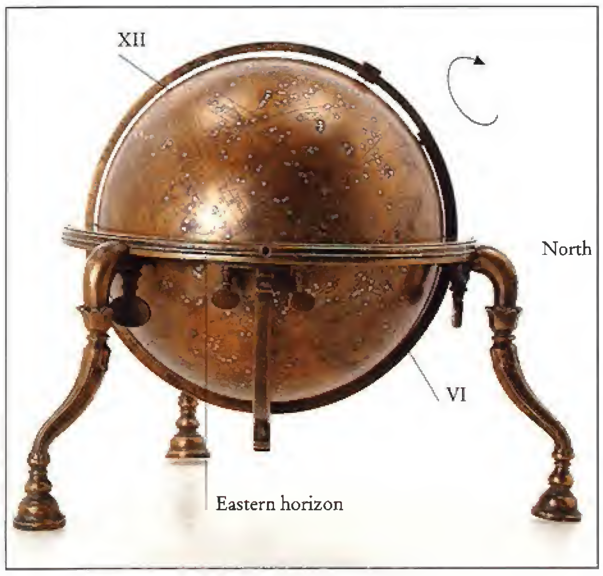


1 If, for example, the Sun at 8° House of Gemini was at a known altitude, the Ascendant – or the beginning of *Locus* I of the horoscope – is the degree of the ecliptic at the eastern horizon. The 'Middle of the Heaven', or the point of the ecliptic at the upper half of the meridian ring, is the initial point of *Locus* X of the horoscope.

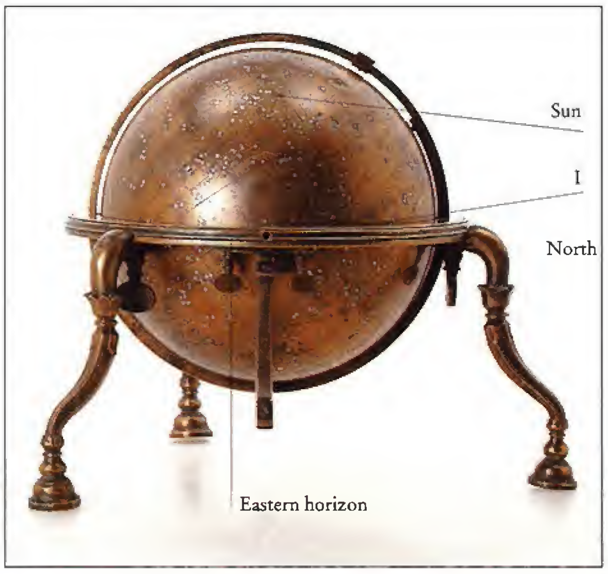
2 With the sphere in the same position, the Descendent, or *Locus* VII, is the degree of the ecliptic at the *western* horizon ring, and the 'Peg of the Earth', or *Locus* IV, is the point of the ecliptic at the bottom or nadir of the meridian ring.



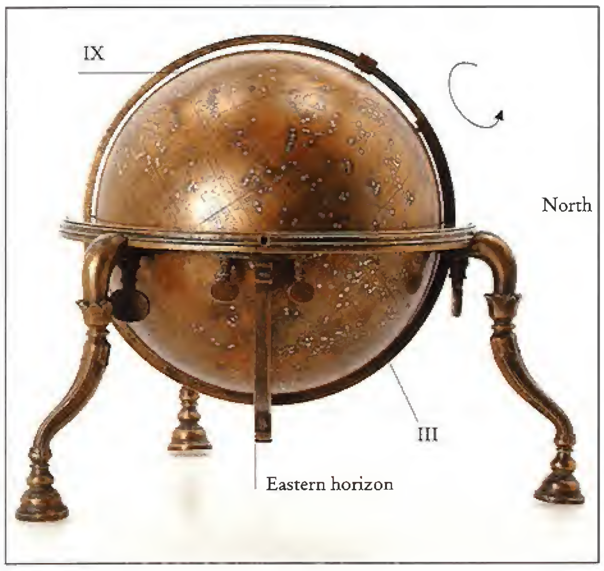
3 Having previously determined the length in minutes of the unequal daylight hour on that day, for example, 72 minutes and 20 seconds, then double that amount, giving 144 minutes and 40 seconds, or two unequal hours, and divide by 4 to find the equivalent angular distance of that time interval, for example, 36° 10′. For practical purposes, given the approximate nature of the globe, the equivalent angular distance of two unequal hours is rounded to the nearest half degree, which in this example is 36°. Then rotate the sphere *westward* from its initial position by that amount, that is, 36°, measuring along the equator. In this new position, the beginning of *Locus* XI is at the northern meridian ring and the start of *Locus* V is at the lower meridian.



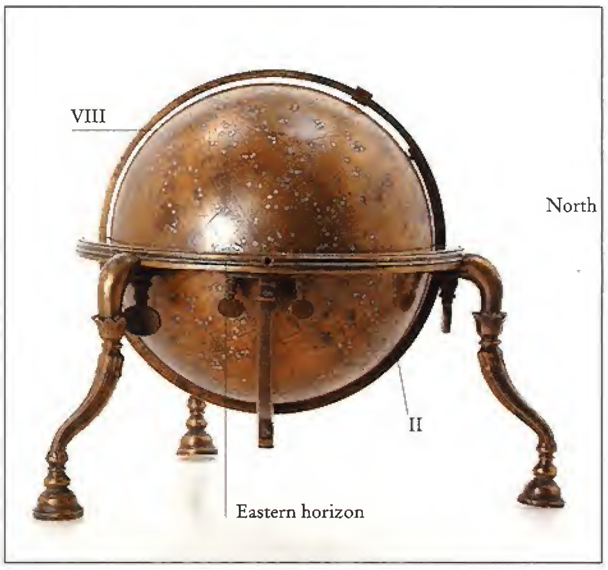
4 Rotate the sphere a second time westwards by the same amount, that is, 36°. The ecliptic point at the upper meridian ring is the beginning point of *Locus* XII, and the opposite point is *Locus* VI.



5 Return the sphere to its original position, with the Ascendant at the eastern horizon.



6 Rotate the sphere *in the opposite direction*, eastwards, through the angular distance equivalent to two unequal night hours of that day – that is, subtract the previous amount from 60°. For example, 24°, that is 60°minus36°. In this new position, the beginning of *Locus* IX is the point on the ecliptic at the upper meridian, and that for *Locus* III is at the lower meridian.



7 Then rotate the sphere eastwards a second time by the same amount , for example 24°, and read the beginning of *Locus* VIII at the upper meridian, and *Locus* II at the lower meridian.

1. For these and further uses, see Kennedy 1989; Worrell 1944; Lorch & Kunitzsch 1985, and Lorch 1980. A celestial globe could also be used to determine the qiblah, or the direction of Mecca; see King & Lorch 1922, pp.201–2.
2. When a 90°-arc is attached to the sliding sleeve, as occurs on some globes, such as cat.141, the sleeve can be moved to the zenith and the point of the ecliptic representing the Sun can be placed along side the appropriate reading for the altitude. A separate 90° graduated arc made to fit the globe may also be used, and this rests on the horizon ring with its upper end extending to the zenith. Instead of a sliding sleeve, some treatises speak of using a hole drilled directly into the meridian ring and then rotating the entire meridian ring, with attached sphere; see, for example, Kennedy 1989, p.55.
3. The method is equivalent to the hour-lines method, using unequal hours; see North 1986, pp.20–27, *cf.* pp.56–69 for a method using planispheric astrolabes.

The planispheric astrolabe[1]

by Francis Maddison

For a piece of copper, worth 5 dirhams, when wrought into an astrolabe is worth 100 dirhams, and this price is not for the matter but for the form that has been impressed on it.
Ikhwān al-Safā', second half of the 10th century[2]

Qui s'offrira d'abord? Bon, c'est cette Sçavante
Qu'estime Roberval, et que Sauveur frequente.
D'où vient qu'elle a l'œil trouble, et le teint si terni?
C'est que sur le calcul, dit-on, de Cassini,
Un astrolabe en main, elle a, dans sa gouttière,
A suivre Jupiter passé la nuit entière.
Boileau (1636–1711)[3]

Six hundred years, a large geographical expanse, two linguistic families, and the scientific cultures of two religious traditions separate the comment made in the 10th century by the *Ikhwān al-Safā'* ('Brethren of Purity'), a scholarly society centred on Basra, with connections in Baghdad, from the verses written in 17th-century Paris by the satirist Boileau. When the Brethren were compiling their epistle on the manual crafts, the astrolabe already had a transcultural history of 900 years, reaching back to Hellenistic times, in particular to Ptolemy of Alexandria in the second century of our era. Few astrolabes were made in western Europe after the 17th century; Boileau wrote at the historical end of a tradition, at a time when the activities which required the use of an astrolabe were better served by other, more specialized, instruments. This was not the case in Islam where, because of the particular needs of Islamic practical astronomy, the astrolabe continued to be of use, often in simplified form,[4] until at least the second decade of the 20th century. Nearly 1200 years is a long period of time for the useful life of an expensive device of some technological and geometrical complexity, of which the classic type changed little during its history. Of the instrument's popularity, there can be no doubt: a total of over 1200 surviving Islamic, Byzantine, and European astrolabes have been recorded. They provide a diagnostic tracer of the transmission of Hellenistic and pre-Islamic Indian learning and instrumentation to early Islam, thence to al-Andalus and from there to medieval Christian Europe in the north, and to the Maghrib in the south; and, later, to Mughal India and to Ottoman Turkey.

The astrolabe '... est à lui seul le symbole de l'astronomie ...'; in western Europe, in medieval sculptures and manuscript miniatures, the astrolabe serves to evoke Ptolemy or the muse Urania.[5] In Islam likewise, it is described as part of the paraphernalia of the astrologer in the stories of *The Thousand and One Nights*;[6] it is depicted in Mughal, Persian and Ottoman paintings[7] among the equipment of both the lone astronomer[8] and observatories.[9] In each culture, the prestigious origins of the astrolabe no doubt counted for something, as did its evident complexity and ingenuity linked with its portability. But clearly a wide nexus of associations contributed to its permanence as an icon.[10] Beyond the mystique, it is sometimes difficult to discern the scientific users and the value of their practice, given the often serious errors in the data incorporated in some astrolabes. Nevertheless, the translation of texts from Hellenistic and Byzantine sources – and probably the copying of examples[11] – provided early Islam with an instrument that solved problems related to the three main concerns of Islamic astronomy:
1. astrology;[12]
2. finding the azimuth of the qiblah, that is the direction of Mecca;[13]
3. the determination of the astronomically-defined times of Muslim prayer.[14]
The first of these, astrology, was a Hellenistic inheritance, whereas both the latter were Muslim concerns not envisaged by the Hellenistic developers of the astrolabe.[15]

An astrolabe is an analogue computing device, usable for the solution of problems connected with time-telling, and in the teaching of astronomy and in the practice of astrology. A star-map (in Latin, rete, Arabic *'ankabūt*), bounded by the Tropic of Capricorn and including a graduated representation of the ecliptic – the apparent path, seen from the Earth, of the sun through the 'fixed' stars, as opposed to the 'wandering' stars or planets – is rotatable about a point representing the celestial North Pole. The star-map is the mirror image of the modern, widely sold, plastic rotatable star-maps, being the view of the stars as seen *on* a globe, not as seen from the earth. Generally, the position of each of the brighter stars selected for the star-map is marked by the sharp tip of a pointer, and the name of the

star is engraved at the base of the pointer. The star-map fits closely within the rimmed body (in Latin, mater, Arabic *umm*) of the astrolabe, which is provided with a bracket (Arabic *kursī*), to which two suspension-rings are attached. Most Islamic astrolabes, where the larger suspension ring is too small to hold by putting a thumb through, originally had a suspension-cord (Arabic *ʿilāqah*), which was often elaborate and had a tassel.

The mater contains several circular plates, known in Latin as *tympana*, and in Arabic as *ṣafāiḥ*, the singular of which is *ṣafīḥa*. Each plate was prevented from rotating by a lug projecting into a slot in the mater, or by a notch engaging with a lug on the inside of the rim of the mater. The plates were made for use in different latitudes, and were engraved with the horizon-line for a particular latitude and circles of altitude (almucantars) – drawn for every degree, every 3°, every 6°, and so forth as appropriate to the size of the astrolabe – between that line and the zenith at the particular latitude. The central hole, as on the rete, represents the celestial north pole. The latitude for which a plate is made is usually engraved in a crescent-shaped space in the centre between the horizon-line and a curved line at the top of the unequal-hour lines. This space is crossed vertically by the meridian-line, and the latitude is inscribed in *abjad* numeral notation[16] on the right of this line, either just as a number, or preceded by the words, 'for latitude …'. On the smaller plates, the latitude is marked just as a number representing degrees; on the larger examples, this is followed by another number representing minutes of arc. It is interesting that on a few of the more elaborate astrolabes the absence of minutes of arc is indicated by the symbol ζ̄ deriving from the columns of numerals in Greek manuscripts, where ō, an abbreviation of *οὐδέν* ('nothing'), signifies the absence of a numeral; in fact, *abjad* is not a place-notational system. To the left of the meridian-line, the number of hours and minutes in the longest period of daylight in the year at that latitude is given, for example '12 24', sometimes preceded by the word, 'hours' (see the illustration on p. 202).

On many Andalusi and Maghribi astrolabes, this information is supplemented by a brief list of places on the particular latitude and for which, therefore, the plate is suitable. Apart from those mentioned, other lines are variously engraved on plates: azimuths, usually above the horizon, sometimes below; the twelve astrological houses; lines of dawn and dusk, below the horizon; and hour-lines, below the horizon. Only the later European astrolabes have lines of equal hours (on the limb of the mater), because the peoples of Islam had no need of such hours. On the plates the usual hour-lines for a particular latitude are lines for unequal, or planetary, hours, that is, hours determined by dividing the time between sunset and sunrise into 12 equal divisions, six o'clock being midnight, and between sunrise and sunset into another 12 equal divisions, six o'clock being midday. Only at the equinoxes will the night hours equal in length the day hours, the former being longest and the latter shortest at the winter solstice, and *vice versa* at the summer solstice. Two other horary systems are sometimes drawn over the unequal-hour lines, especially on Mughal astrolabes, which often have very complex plates: lines for *horae ab ortu solis*, known in Europe as Babylonian hours, and *horae ab occasu solis*, known as Italian hours. In both systems the intervals between the starting and the ending points (sunrise to sunrise for Babylonian hours, sunset to sunset for Italian hours) are divided into 24 equal divisions, but owing to the different times of sunrise and sunset, the number of hours relates to different times in the day. Muslim prayer-times are astronomically defined, and lines for the prayer-times are usually marked by dotted lines on Andalusi and Maghribi astrolabes.[17]

To use the astrolabe in observation, it must be provided with a sighting-rule – an alidade – equipped with a pair of perforated sight-vanes. The sighting-rule is normally on the back

of the astrolabe, where it can rotate over a scale of 90°, in order to determine altitudes of a star or of the Sun. The back of an astrolabe is usually engraved with other useful scales. Centrally, in the lower half of the back, for example, there is usually engraved a 'shadow-square' (normally, in fact, a rectangle) of direct-reading trigonometrical functions for elementary surveying, and, on the limb, associated co-tangent scales. Another common scale was a sexagesimal sine-cosine (or just sine) quadrant. Another, on Iranian astrolabes, was the quadrant of a projection of the signs of the zodiac, with ingenious graphs of arcs of circles enabling the direction of Mecca to be found at various places (see below, p.272), by the altitude of the declining Sun. On Iranian instruments, in the same quadrant, there were often graphs of the meridian altitude, throughout the year, of the Sun in various latitudes. These graphs also took the form of arcs of circles on Iranian instruments, sigmoid on Mughal instruments, owing to the different nature of the projection. Iranian and Mughal instruments often included astrological tables correlating the 28 mansions of the moon with the signs of the zodiac, and the terms, faces, and limits of the planets. *Andalusī* and *maghribī* astrolabes have a zodiac/calendar scale correlating the signs of the zodiac with the Julian calendar, designated by Arabic transliterations of the Romance month-names.

The astrolabe is held together, while permitting the rotation of the alidade and the rete, by a pin passed through the alidade, then from the back through the mater, plates, rete, and rule. This was a simple pivoting ruler, useful for determining straight-lines, such as those from solar positions in the zodiac to hour-lines, and for declinations, but it was not always present. It was held in place by a wedge, in the same way that the wheels of some early wagons were retained on their axles. The rete and the plates were drawn in stereographic projection, a useful geometric technique which retains the true value of angles measured radially from the centre, though it distorts areas and shapes. Thus, for example, both rete and plates are bounded by the Tropic of Capricorn which, in the stereographic projection, is of much greater diameter than the Tropic of Cancer, and beyond it the distortions would become unreasonably great.

The early history of this geometric procedure is obscure, but was certainly known, in the second century of our era, to Ptolemy of Alexandria, who used it for his planispheric astrolabes.[18] In the planispheric astrolabe as here described, the projection is from the southern celestial pole on to the plane of the equator.

It would be otiose, in view of the number of descriptions of the construction and use of the astrolabe which have appeared, to repeat that information here.[19] Instead, the illustrations on pp.202–205 show the practical use of one of the astrolabes in the Collection.

From Hellenistic and Byzantine sources, early Islam acquired the theoretical and practical knowledge to build astrolabes. The earliest surviving astrolabes are Islamic, and date from the 9th century AD. Many of the names of the first makers of astrolabes are recorded by Ibn al-Nadim in his *Fihrist* ('Index', a sort of bibliography of early Islamic writing), in the 10th century, and from this, and surviving instruments, it is possible to construct a 'genealogical' table of master–apprenticeship relationships.[20] Sometimes these relationships are also familial.[21]

Most astrolabes were made of metal, possibly a quaternary alloy of zinc, copper, tin and lead. Technically either bronze or brass, it is, for the sake of consistency and in the absence of systematic metallurgical analysis, always described here as 'brass'. Although metallurgical analysis may occasionally serve to identify modern fakes, particularly in the light of their high zinc-content, little may be expected from this procedure in the identification of instruments from particular workshops, or even regions (see p.173). Apart from the visible

diversity of 'brasses' used in the construction of a single instrument, it must be recalled that a great deal of recycled metal, some of it from far afield, was used. For instance, a Jew, Abraham Yiju, operated a bronze factory in India in the late 1130s, and copper, tin and old bronze vessels from Spain were exported to him in Aden.[22]

In terms of construction, the rete and plates are of beaten sheet-brass (the rolling mill was first invented in 15th-century Europe for producing metal-strip for coins); the mater was cast in one piece, or else a sheet, to form the back, was riveted to a cast or wrought rim. A few astrolabes, mostly in Turkey, were made of wood and pasteboard, with the inscriptions drawn in ink, and there are a few didactic or pattern instruments of stone.[23] The general use of metal, cast and beaten, and the associated decorative techniques – ornamental engraving, working *à jour*, 'damascening' (inlaying of precious metals) – suggest that makers of globes and astrolabes were metal-workers, and no doubt craftsmen specializing in various techniques were employed in ateliers, or sub-contracted, but in nearly all cases where something is known about an astrolabist, he proves to be at least an astronomer of sorts, such as an astrologer or a *muwaqqit*, whose task was to determine prayer-times in a mosque.[24]

The point is confirmed in the long account of Safavid astrology and astronomy by the traveller and jeweller, Sir John (Jean) Chardin FRS (d. 1713). Born in Paris in 1643, Chardin went to Turkey, Persia, and India between 1664 and 1670, and again betwen 1671 and 1677, and wrote: 'The reason why astrolabes are so well made is because, usually, they are made by the astronomers themselves; it is not that there are not professional artisans for mathematical instruments, but those that they make are not valued as much as those made by mathematicians, who are not so likely to make an error numerically, and who mark more accurately the numerals and diagrams. To that must be added that an astronomer is not considered a learned man, if he does not know how to make all the instruments himself, and if he does not work better than a skilled artisan.'[25]

The Superior of the Capuchin monks in Isfahan, with whom Chardin stayed, introduced him to 'the astrologer most famous for the making of astrolabes', Muhammad Amin, 'a man as learned as he was an excellent artist ... apart from knowing thoroughly his science, he had the surest possible hand for constructing mathematical instruments.'[26]

Among the techniques of manufacture observed by Chardin are the use of a ruler and dividers of iron and steel, a special plate, or protractor of brass, the *dastūr*: '... the principle instrument which they have for the true and accurate construction of their astrolabes ... this Persian plate ... with which the astrologers of the country make their instruments exact and precise, without much calculation or computation, as is done elsewhere.' The astrolabists also used, for the division of the mater, a large copper or lead bowl, in the centre of which the mater was carefully fixed with mastic, so that degree divisions on the limb of the mater could be laid off from those already divided on the edge of the bowl.[27] Chardin describes in detail the nature and use of these tools, but omits any mention of the use of tables of almucantars in drawing the plates.

Astrolabes and other scientific instruments naturally partake of the styles of metalwork of the periods and places where they were made. The earliest Islamic astrolabes were made in the Syro-Egyptian region,[28] and among the early astrolabists and astronomers of Islam, there are several whose *nisbah* is al-Harrani; Harran was a pagan Sabian city, a centre for translation from Greek and Syriac.[29] From the late 10th century onwards astrolabes were also produced in Iran.[30] The early style is simple: it consists of straight 'dagger-shaped' star-pointers, or ones which are slightly curved (cat. 122); essential lines only on the plates and

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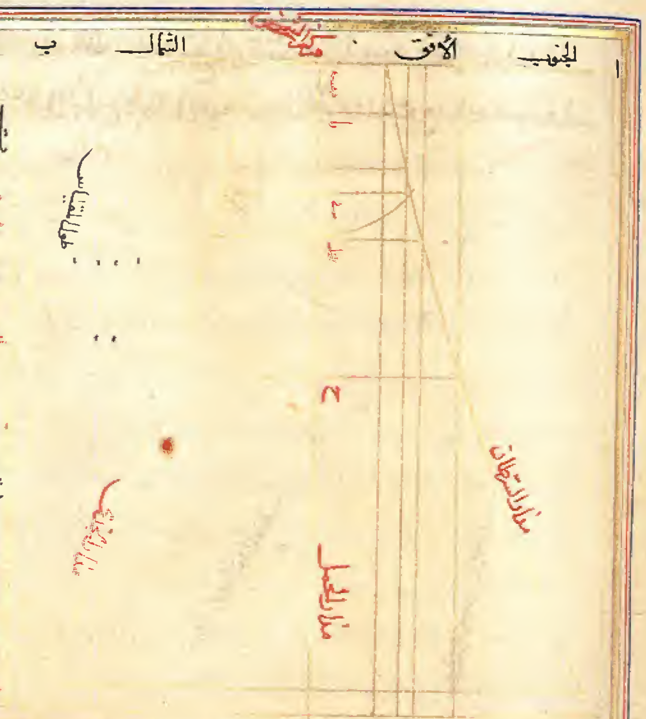

اوّل الجدي

	البعد اصابع	البعد دقائق	الظل اصابع	الظل دقائق
ا	ه	يه	ع	ع
ب	ه	كر	ح	لح
ج	و	ح	و	نه
د	ر	كه	س	ع
ه	ے	ل	ك	مج
و	ك	نو	مد	لح
عصر	و	مب	ط	لد

عصر الحمل
ع ع س ع

اوّل السرطان

	البعد اصابع	البعد دقائق	الظل اصابع	الظل دقائق
ا	ه	يه	ع	ع
ب	ه	كر	ح	لح
ج	و	ح	و	نه
د	ر	كه	س	ع
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هي علامة اوّل الساعة الاولى من نهار اوّل السرطان وانما عملناها في الأفق لانها ليس لها بعد مستعمل وانما عملناها الى
مايلي الجنوب لان بعدها جنوبي ثم ناخذ من الجدول بعد الساعة الثانية من النهار المذكور وهو خمسة اصابع
و ٢٧ دقيقة في الجنوب فناخذ من المسطرة مثل ذلك بالبركار ونضع احد طرفيه في مركز الشخص ونعلم بطرفه
الاخر في الأفق علامة الى مايلي الجنوب ونخرج من هذه العلامة خطا خفيا يكون عمودا على الأفق ثم
ناخذ بالبركار من اجزاء المسطرة مثل الظل المستعمل للساعة الثانية من النهار المذكور وهو ثلثة اصابع و
١٣ دقيقة ونضع احد طرفيه في الأفق على اوّل الخط الخفي ونعلم بطرفه الاخر في الخط علامة وهذه العلامة هي علامة
الساعة الثانية من النهار المذكور ثم ناخذ بالبركار من اجزاء المسطرة مثل البعد للساعة الثالثة من هذا
النهار وهو ستة اجزاء وثلاث دقايق في الجنوب ونضع احد طرفي البركار في مركز الشخص ونعلم بطرفه الاخر في الأفق علامة
الى مايلي الجنوب ونخرج من هذه العلامة خطا خفيا يكون عمودا على الأفق ثم ناخذ بالبركار من اجزاء
المسطرة مثل الظل المستعمل لهذه الساعة وهو ستة اجزاء و ٥٥ دقيقة ونضع احد طرفيه في الأفق
على اوّل هذا الخط الخفي ونعلم بطرفه الاخر في هذا الخط الخفي علامة وهذه العلامة هي علامة الساعة الثالثة
من النهار المذكور وهكذا نتمم باقي حدود الساعات ونصل بين هذه الساعات على ما تقدم ذكره وان كان
البلد الذي تريد عمل ذلك له ذا عرض فان كان عرضه اقل من تمام الميل الأعظم البلد الذي عرضه

118, folios 116b–117a

فى اخر الساعة التى انت فيها فحرك اللوح يمنة ويسرة وهو قايم على الأفق الى ان يقع طرف ظل المقياس على حد اخر الساعة
فاذا كان كذلك فثبت اللوح على ذلك الوضع بالبنا والله اعلم وللنا فى رسم هذه الساعات وجه اخر بالبعد والظل
المستعمل وهو المشهور عند الناس والوجه الذى تقدم ذكره غريب فى عمله ٥ اذا اردت ذلك فاستخرج لأبعاد
والظلال المستعملة لحدود الساعات التى استخرجت ظلالها وسموتها فى سطح دايرة نصف النهار بالحساب
او بالهندسة والحساب اجود لما قدمناه ورتب جميع ذلك فى جدول ثم تستخرج مركز الشخص الأطول على ما تقدم
ثم تستخرج الشخص الأطول وذلك انا نطلب فى الجدول اطول بعد وقع فيه فنجده بعد الساعة السادسة وهو
عشرون اصبعا وستة عشر دقيقة فنكمله احدى وعشرون اصبعا ونقسم خط ها بمثل هذه الأصابع
ثم نطلب فى الجدول اطول ظل مستعمل وقع فيه فنجده الظل المستعمل للساعة السادسة وهو ٤٤
اصبعا و٣٥ دقيقة فنكمله ٤٥ اصبعا فان كان ا د ٤٥ جزءا من اجزاء ا ه او اكثر فاثنى عشر جزءا من اجزاء
ا ه هو الشخص الأطول وان كان اقل فتمنا ا د ٤٥ جزءا ويكون الشخص الأطول اثنى عشر جزءا

من هذه الأجزاء واذا كان قدر الشخص معلوما فاعمل المسطرة على ما تقدم ثم اطلب فى الجدول بعد الساعة
الأولة من نهار اول السرطان وهو خمسة اجزاء وربع وخذ بالبركار من اجزاء المسطرة قدر خمسة اجزاء وربع
وضع احد طرفيه فى مركز الشخص اعنى نقطة ٥ وعلم بطرفه الأخر فى الأفق علامة الى ما يلى الجنوب وهذه العلامة

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The *Jāmiʿ al-mabādiʾ wa'l-ghāyāt* of al-Marrakushi

Iran or India,
dated AH 1070 (AD 1659–60)

266 folios, 30.8 × 19.2 cm, of highly burnished, thin, beige paper, laid with 8–9 lines per centimetre; text area, 21.8 × 12.1 cm (within ruled frames), 28 lines to the page, written in *naskh* in black, red and gold [1]
scribe Ibn Mir ʿAbd Allah Mir Jaʿfar al-Husayni al-Tabrizi
binding dark brown leather, the covers and envelope flap framed by single gold rules, and red leather doublures. The spine is modern.
accession no. MSS 358

118, folio 197b

This careful and complete copy of the *Jāmiʿ al-mabādiʾ wa-al-ghāyāt* ('Compendium of principles and objectives') by Abu ʿAli al-Hasan ibn ʿAli al-Marrakushi was produced in Iran or India and is consequently significant to historians since it demonstrates knowledge of al-Marrakushi's treatise in the eastern Islamic lands. The treatise, compiled about AH 680 (AD 1281–2) in Cairo, is undoubtedly the most important written source for medieval Islamic astronomical instrumentation and yet previously there has been no evidence that the work was known in the Islamic East.[2] Almost nothing is known of the life of al-Marrakushi, though from internal evidence in the treatise it is evident that he worked in Cairo and his name suggests a Maghribi lineage.[3]

His extensive treatment of spherical astronomy and astronomical instruments is divided into four books (*fanns*) with numerous subdivisions and, in addition to the standard problems in spherical trignometry and astronomy, includes illustrated discussions of sundials, armillary spheres, planispheric astrolabes, universal astrolabes, trigonometric sine/cosine quadrants and quadrants for determining time from solar altitude. No edition of the text has been published and only one other extant copy is complete.[4]

The author's name is given at the opening of the treatise (folio 10b, line 2) as Sharaf al-Din Abu ʿAli al-Hasan ibn ʿAli ibn ʿUmar al-Marrakushi, with the title given on folio 11a, lines 14–15. From the scribe's name, Ibn Mir ʿAbd Allah Mir Jaʿfar al-Husayni al-Tabrizi, given in the colophon on folio 266a, it is evident that this is an eastern copy, and this provenance is confirmed by the style of illumination decorating the volume. On folio 1b there is an illuminated opening for the carefully written table of contents, which fills folios 1b–10a and is in chart format, keyed to small red numerals written in the margins throughout the volume.[5] Illuminated openings also occur at the beginning of the treatise proper (folio 10b), the beginning of the second *fann* (folio 76b) and the fourth chapter (*qism*) of the second *fann* (folio 147b), the beginning of the third *fann* (folio 197b) and the beginning of the final *fann* (folio 256b). The calligraphy and the forms of the numerals are typical for manuscripts from 17th-century Iran and India. The colour tones of the carefully executed illumination also suggest an Indian provenance, though an Iranian one cannot be precluded.

The scribe was meticulous in establishing a sound copy. According to a marginal note made by him on folio 146b, the copy was collated with a copy that had itself been collated with the autograph manuscript, and occasionally, as on folio 236a, the scribe copied a marginal note reproduced from the autograph. This magnificently produced copy is, therefore, important not only because it is the only recorded eastern manuscript but also because it is complete and textually sound. Most of the text is set within blue, red, black and gold rules, and on folios 10b–11a within cloud bands set against a ground of pink hatching. There are rubrications and some interlinear notes in a later hand. Diagrams are executed in gold, red and black ink, with illuminated section headings. Two pieces of paper were pasted over folio 1a during a modern repair, and a flyleaf was added after folio 266.

1. Folios 147a, 197a and folio 266b are blank except for the ruled frame.
2. King (1990) says that the surviving manuscript copies are of Egyptian, Syrian or Turkish origin and that the work was apparently unknown in the Maghrib as well as the Islamic East.
3. King 1983, pp.539–40; King 1986a, pp.58, 59; and King 1990.
4. See King 1986a, p.59 for copies; a manuscript in the Topkapı Palace Library, Istanbul, MS.A.3343, was published in facsimile in 1984 by the Institut für Geschichte der Arabisch-Islamischen Wissenschaften in Frankfurt (series C, volume 1 in two parts). The first half of the treatise was translated into French by J.J. Sédillot (1834–5), while the second half was inadequately summarized by his son, L.A. Sédillot (1844), employing two incomplete copies in Paris.
5. The manuscript was later foliated (with omissions) in very large Arabic numerals.

on the back; and a low, or medium high *kursī*, often pierced with two holes, symmetrically disposed on either side of the vertical centre line.[31]

While retaining some aspects of the design of these early astrolabes, those made in the Ayyubid period become more complex, with zodiac/calendar scales (for Syrian Christian months), and sometimes with inlaid decoration. Though some *naskh* script is used as decoration on these 13th-century astrolabes, the basic script is in a simple, non-serifed, Kufic, known sometimes as 'astronomical Kufic', because of its use on astronomical instruments.[32]

Astrolabes began to be made in Islamic Spain in the 10th century, shortly after those in the East. Andalusi astrolabes are characterized by the presence on the back of the Julian zodiac/calendar scale; by characteristic 'wavy-flame' star-pointers, springing from squarish bases, which are sometimes perforated, and usually ornamented with a silver knob; by notches, to facilitate use in dim light, at 10° intervals on the degree-scale of the altitude-quadrant on the back; and by the use of the fairly thick, heavily serifed, Andalusian Kufic script. Very few astrolabes were made in Islamic North Africa, before the fall of the Nasrid Kingdom of Granada in 1492 and the expulsion of the 'Moors' from Spain.[33] The subsequent Maghribi astrolabes, nearly all from Morocco, in particular Fez and Marrakesh, continue in the tradition of those from Spain, except that the Kufic script, while remaining characteristically Maghribi, becomes lighter and less mannered. Astrolabes were made in North Africa, almost up to the present time. (For Andalusi and Maghribi astrolabes, see also below, p.260.)

In Islamic India, there was a continuous history of astrolabe-making from the latter decades of the 16th century through to the end of the 17th. For the most part they were astrolabes and globes made by members of the same family at Lahore (see below, p.219), the first recorded astrolabist of the family being Allahdad, who seems to have been officially attached to the imperial court of the Mughal Emperor Akbar (*reg.* 1556–1605).

The backs of Mughal astrolabes, as already mentioned, are usually engraved with astrological tables. Because of this, and because they are often equipped with more plates than usual, frequently elaborate ones, and have a full range of stars on the rete, Mughal astrolabes give the appearance of great complexity, despite the use of a generally clear *naskh* script. The *kursī* is fairly characteristic, being a high triangle worked *à jour*. Astronomical instrument-making continued in India, both Islamic and Hindu (where instruments are engraved in sanskrit in *devanāgarī* script), through the 18th and 19th centuries and the beginning of the present century. Many of the maharajahs had their private astrologers, such as the Lahore astronomer, Lalah Balhumal, who was employed by the Maharajah at Kapurtala in the middle of the last century; they also made instruments, and some of their productions are large and novel.[34]

Artistically the most elaborate astrolabes come from Iran, mainly from the Safavid period, in particular from the reign of Shah 'Abbas II (1642–1666) to that of Shah Husayn I (1694–1724). On these Safavid astrolabes the rete is composed of elaborate foliate tracery, and the script, which is *naskh* or variations of the type, becomes an important decorative characteristic; it fills up available space, and is often engraved against an ornamental background. Quotations from the Qur'an and dedicatory inscriptions are engraved on the *kursī*, and a verse from the 13th-century poet Sa'di, contrasting the impermanence of life with the permanence of engraving, is popular, at the base of the back.[35] Persian astrolabes often record the name of the decorator, as well as that of the maker, though these two activities are not distinct: the maker of one astrolabe may appear as the decorator on another. One 18th-century Persian astrolabist, Hajji 'Ali (see below, cat.149), recorded the 'opus'

number of several of his astrolabes, and usually the date also.[36]

The language of all the Islamic astrolabes is essentially Arabic, because it is the classical language and the Arabic star-names and technical terms are loan-words in Persian, Turkish and Urdu, which are the main other languages used in places where astrolabes were made. Persian, however, is found where there are dedicatory inscriptions, or verse quotations, on Persian astrolabes, even though the Safavid court spoke (Azeri) Turkish.[37] Not all astrolabes are signed, and not all signed astrolabes are dated. The signatures are usually on the back: numerous variations occur, but, commonly, examples can be found on the back of the *kursī*, or around the edge of the lower left quadrant, on early astrolabes; above and on either side of the shadow-square on Mughal astrolabes; in a cartouche below the shadow-square on Persian astrolabes. The signatures usually begin either with the verb and pronoun 'he made it' – *ṣana'ahu* (m.) (*ṣana'ahā* would be used on a globe, because the Arabic word for globe is feminine) – or with one of the nouns meaning 'work, *opus*' – *ṣana'ah* or *'amal*. On Iranian astrolabes, there is also sometimes the signature of the 'decorator', beginning *nammaqahu* ('he decorated it'). On a few astrolabes, further details are given; for instance, an Ayyubid astrolabe gives the name of the 'designer / calculator', the maker, and the inlayer, and a Safavid astrolabe gives the name of the astronomical supervisor, as well as those of the maker and calligrapher.[38] The dates are usually given only in the *ḥijrah* era, though other eras are sometimes recorded as well on Mughal instruments. The dates are nearly always written not in Hindu–Arabic numerals, but in *abjad*, that is, the Arabic alphabet used numerically. The numerals on the scales and in the tables, and on the plates, are also written in *abjad*.[39]

The engraving of the necessary scales on the astrolabe required great precision if the instrument were to achieve even the most rudimentary accuracy in use, and indeed, the engraving on the best astrolabes is of a high order. However well engraved, most astrolabes are in fact far too small to have provided very exact results. Sir John Chardin's unique description of methods used by the Persian astrolabists in designing and manufacturing their astrolabes has been mentioned above. How much of an astrolabe was marked out in the manner described by Chardin is not clear, nor indeed how universal this procedure was. On some astrolabes, the rete has lines scatched on the back showing that the design was first sketched out on one side of the sheet of brass and then cut out and engraved on the other side.

There survives, probably from the 18th century, a Persian astrolabist's board for dividing the scales on an astrolabe, and this may be seen as a simplification of the procedure described by Chardin.[40] Scales, drawn in ink on paper, are mounted on a wooden board, which contains a recess to take the mater of an astrolabe. The board serves as a protractor for laying off the meridian and east-west lines, the scales of degrees on the limb and around the edge of the back, the co-tangent scales and the shadow-square on the back of a small astrolabe, but can be used for only one size of astrolabe.

Treatises on the construction and the use of the astrolabe are common in Islamic literature. Perhaps the first was that written by Masha'llah, a Jewish astrologer who died in about AH 200 (AD 815), and who, with the Iranian al-Nubakht, directed the preliminary surveying for al-Mansur's foundation of Baghdad in AH 145 (AD 762–3). Another well-known early treatise is that on the use of the astrolabe by 'Ali ibn 'Isa al-Asturlabi, a maker of astrolabes as well as a practising astronomer, who made observations in Baghdad and Damascus in AH 214 (AD 829–30) and AH 217 (AD 832), and who took part in the expedition in the plain of Sinjar (between the Euphrates and the Tigris) on the orders of the Caliph

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Fake planispheric astrolabe
Probably Iran, 20th century

Brass, cast and sheet, cut and engraved
diameter 12.2 cm
maximum height 17.2 cm
(excluding suspension ring)
accession no. SCI22

This astrolabe is certainly a fake, for, among other errors, the tracery of the rete is symmetrical; the names of the signs of the zodiac are engraved in the reverse direction; and, although the four plates appear to have been inscribed for different latitudes, some are the same!

Some clue as to its date of manufacture may be made, paradoxically, by the maker's inscription, which reads 'Muhammad ibn Khidr al-Asturlabi made it in the year /kh-s-z/', that is, in AH 697 (AD 1297–8). No astrolabist called Muhammad ibn Khidr has been recorded, but the name recalls that of the famous astronomer, Hamid ibn al-Khidr al-Khujandi (d. *circa* AD 1000), to whom one surviving signed astrolabe is attributed.[1] The maker of this astrolabe, which is dated AH 374 (AD 984–5), was not fully publicly identified until 1960,[2] but already in 1956 the name of the maker's father had been read as 'al-Khiḍr',[3] on the basis of an anonymous manuscript note reproduced in 1932.[4] This fake astrolabe may therefore have been made after 1956. It belongs to the first group of fakes discussed on p.196, and is better in some respects than several other similar fakes, apparently from the same workshop, the inscriptions on which are seriously garbled.

1. Louisiana 1987, no.43 and p.26; Brieux & Maddison, forthcoming, 'Ḥāmid b. al-Khaḍir al-Khujandī'.
2. Destombes 1960, p.14, nos 23, 24; Destombes saw the astrolabe, which had been lost since 1929, in Paris.
3. Mayer 1956, p.45.
4. Gunther 1932, I, p.245, no.111, figs 118, 19.

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al-Ma'mun, to measure a degree of the meridian. His contemporaries, the astronomers Muhammad ibn Musa al-Khwarizmi and Ahmad ibn 'Abdallah, known as Habash *al-ḥāsib* ('The calculator'), wrote respectively on the use and construction of the astrolabe. Al-Sufi's 'The Book of the Use of the Astrolabe' (*Kitāb al-'amal bi'l-asṭurlāb*) with its 386 chapters, illustrates the extent and comprehensiveness of those early treatises, wherein the authors attempt to demonstrate every conceivable use of the instrument, with scant regard to the didactic value of some of the problems and solutions. There is some evidence from the treatise of Indian influence upon al-Sufi, and it has been suggested that he was 'one of the "adherents of the Sindhind" (*aṣḥāb al-Sindhind*)' so often mentioned in the literature. In Muslim Spain, a pupil of the outstanding mathematician and astronomer, Maslama ibn Ahmad al-Majriti (d. AH 398 [AD 1007–8]), of Córdoba and later Denia, Abu'l-Qasim Ahmad ibn 'Abdallah ibn Umar, known as Ibn al-Saffar ('Son of the coppersmith'; d. AH 426 [AD 1034–5]) wrote a treatise on the use of the astrolabe, praised by Sa'id al-Andalusi, writing in AH 460 (AD 1068), as concise, well ordered, and easily understandable. Ibn al-Saffar's brother was a famous astrolabist of whose work two examples survive. It is not surprising to find among the numerous excellent works of al-Biruni (*circa* AD 1000) a particularly exhaustive treatise on astrolabe-making. Reference should here be made to the fine manuscript in this collection of the comprehensive treatise of the late 13th-century Cairo astronomer, Abu 'Ali al-Marrakushi (see cat.118).

Fakes and forgeries

Although little has been published on the subject, the study of fakes and forgeries can be instructive in many ways; two such intruments in the Collection are described because they are fakes of characteristic Iranian astrolabes of different periods, and can serve for comparative purposes (cat.119 and 148). They demonstrate several points of interest, including possible sources, makers and dates of manufacture.

A large proportion of astrolabes in the Iranian styles which have appeared on the market in the last few decades are forgeries and, indeed, a photograph of a maker of such astrolabes at work has been published.[41] Many of these astrolabes are of fairly crude manufacture, and would be unlikely to long deceive someone familiar with genuine Iranian astrolabes. They

For the Meridians, and Parallels
Man hath weav'd out a net,
and his net throwne
Upon the Heavens, and now they are
his owne.

An Anatomie of the World (The First Anniversary), John Donne (1572–1631)[47]

are scientifically inaccurate, with unusable scales and alidade; signs of the zodiac on the ecliptic circle in the wrong order and even, occasionally, 24 signs instead of 12; useless plates with no lug and socket to prevent the plates from rotating in the mater, and astronomically meaningless inscriptions, often with a six-pointed 'Solomon's Seal' diagram in the mater containing the gazetteer; and a high, simple, triangular *kursī*. Much of the engraved script is poorly executed and sometimes illegible; and there is often a 'signature' and 'date' in the gazetteer. The name of the maker is often given as Muhammad Amin, the astrolabist of the late 17th century, and the date, often placed unusually with the signature in the centre of the mater, at the beginning of the 18th century. No instruments of this type are found in the older collections such as that of Lewis Evans,[42] and there was only one, untypical, in Henri Michel's collection;[43] it may, therefore, be deduced from these and other facts that these fakes were probably made after the Second World War.

Though fewer in number than those described above, there are several other unsatisfactory Iranian astrolabes which are equally useless astronomically but are clearly the work of a skilful metalworker. Superficially, they appear to be Iranian asrolabes of the Safavid period; they are finely decorated and bear the signatures of well-known astrolabists such as ʿAbd al-ʿAli and ʿAbd al-A'immah. Arguments that cat.148 might be a copy of a genuine instrument do not address the problem of why a copy should incorporate the following characteristics: the signs of the zodiac on the ecliptic circle of the rete are in reverse order, starting from the right-hand side of the horizontal bar; the star-pointers are not named (though the existence of a misplaced pointer, perhaps meant for *qalb al-asad*, Alpha Leonis, which should nearly touch the ecliptic at *al-asad*, Leo, and the reverse order already mentioned, might suggest the reversal of a tracing), but unlike many instruments in this group the rete is not symmetrical; *al-mīzān* (Libra) on the ecliptic circle is written, incorrectly, as *al-mīdhān* (both sound the same in Persian), as on the other fake astrolabes of the group; the ecliptic projection ratio is above 1:3.80, instead of 1:2.33.[44] The outer, Capricorn band of the rete is engraved with a type of 'Greek key' pattern, familiar from fake, but not from genuine, astrolabes; the limb, divided by fives, is numbered wrongly in *abjad* (it begins, for example, /h/yh/h/y/kh/ ... = 5, 15, 5, 10, 5, 25), though the upper degree scales on the quadrants on the back are correct; the divisions on the shadow square are not radial; the alidade is not of Iranian type and has sights placed too far towards the centre for a planispheric astrolabe; and no lug and socket is provided. In a cartouche below the shadow square on the back, the astrolabe is signed and dated, *ʿAbd al-A'immah sana 1127* ('ʿAbd al-A'immah, year 1127'), but not preceded by *ṣanaʿahu* ('he made it'), as is usual with this maker's signature. The *kursī* is of correct design and finely decorated, and in general the quality of the decoration and engraved script is fair.

Not all the astrolabes in this group are identical, or have the same faults, but there are many common factors. It has been suggested that they may have been made as early as the 18th century, but the 19th or 20th centuries seem more probable. Certainly the forgers were aware of the quality of the work by ʿAbd al-A'immah and ʿAbd al Ali, whose names and, sometimes, also those of their illustrious patrons, were engraved on the fakes.[45] In 1875, in Tehran, Kržiž wrote that '... some ancient astrolabes bearing the names of renowned makers, such as Abdul Ameh, still exist in Persia and are valued at the most extravagant prices'. He added that, *circa* 1850, '... the few remaining examples were sought by the greatest in the kingdom and were easily sold for 50 ducats, so much did they love to have one in their sight, although they could not understand one iota of it'.[46]

1. This essay is solely concerned with ordinary planispheric astrolabes, because there are no universal planispheric, spherical or mariner's astrolabes in the Khalili Collection.
2. From an epistle of the *Ikhwān al-Safā'* ('Brethren of Purity'); cited from Lewis 1943, *Risala* ('Epistle') 8. At this time, three or four sewing needles cost one dirham; see Ashtor 1969, p.56.
3. Boileau – Escal 1966, pp.62–80, Satire x (on women; Juvenal's satire vi, verses 569–81, also on women, mentions a woman astrologer), at p.73; Boileau – Boudhors 1952, Satire x, pp.83–106, vv. 425–30, p.97; partly cited by Poulle 1983, p.13. Boileau's remarks were directed at Marguerite Hessein, wife of Antoine Rambouillet, S[r] de la Sablierè (1636–93). Some 18 or 20 years previously, Madame de la Sablière, who had a salon frequented by illustrious scientists, had there mocked Boileau for his ignorance of astronomy and a blunder about the scientific use of the astrolabe, as evidenced in Boileau's Epistre v (Boileau – Escal 1966, pp.118); Boileau is here taking his revenge, using the same phrase, 'astrolabe en main', as before. See the interesting notes in Boileau – Escal 1966, pp.962–5, esp. 963–4, nn. 4 & 5; 926–9, esp. 936, n.50, and in Boileau – Boudhors 1952, pp.284–303, esp. the persons mentioned, pp.295–6.
4. The astrolabe-quadrant is dealt with below, see pp.268–70.
5. Poulle 1983, pp.13–15.
6. See note 10, below.
7. Sarma 1992; Saliba 1993.
8. For example, the 13th-century astronomer, Nasir al-Din al-Tusi, in a 17th-century Ottoman *Silsilanāmah*, Ankara, Ethnographical Museum, ms.8457, folio 15a; see Sayılı 1960, pl.2.
9. Sayılı 1960, pls 5 and 6.
10. Apart from the quotations at the beginning of this essay, we may note, in Europe, that Heloïse and Abelard in the 12th century named their son Astrolabe. Literary references to the astrolabe, for example, are found in lines 653–9 of the didactic poem 'Microcosime' (1563) by Maurice Scève (*circa* 1510–*circa* 1564); in a moral fantasy for instruction (1564) by the potter and enameller Bernard Palissy (*circa* 1510–*circa* 1589) (see Turner 1987, pp.86 and 283, n.123); in the section about the fantastic boat in chapter 29 of Miguel de Cervantes' *Segunda parte del ingenioso cavallero Don Quixote de la Mancha* (1615), which may refer to a mariners' astrolabe because Cervantes was familiar with navigation, but he had also been a prisoner in Algiers (*cf.* Murillo 1975, pp.39–40); and, more recently, in chapter v of the Soviet humorous novel (1928 [1961]) by Il'f & Petrov: '*Sama meryet ... bylo by chto meryat*"/ 'It measures by itself ... provided you have something to measure', but *astrolyabya* in Russian can also mean a theodolite; and in the children's novel by Bryce & de Vere Stacpoole (1949) (a mariner's astrolabe, but also a place, 'Astrolabe Islet'), and Stewart 1977 (the name of a painting of the Virgin and Child, and the title of the novel). In Islam, the classic literary use of the astrolabe occurs in *Alf layla wa-layla* ('Thousand and One Nights'), in the Taylor's Tale, 'The Lame Young Man from Baghdad and the Barber', which is subsumed in the story of the Hunchback, where the barber refuses to shave a man's head until he has made an astrological prediction, using his astrolabe, which, with details of the astrological data, is described as inlaid with silver; the date is AH 653 (AD 1255–6) (see Maddison 1992d; *Alf laylah wa-laylah*– Mahdi, 1, p.335; and the English translation of Mahdi's text, *Alf laylah wa-laylah*–Haddawy 1990, p.225. A second mention of an astrolabe, this time of gold, with a geomantic table, in *The Thousand and One Nights*, occurs in the Tale of Qamar al-Zaman and his Two Sons (quoted from Richard Burton by Irwin [1994, p.190]; it is not found in the French translations by either René R. Khawam [1986] or J.C. Mardus [1889] but is found in *Alf laylah wa-laylah*–Haddaway 1995, p.197).
11. *Cf.* the description by al-Biruni, *circa* AD 1000, of a geared calendar movement (later used by Muhammad ibn Abi Bakr in an astrolabe (see cat.122 below), which derives from a Greek sundial (see Wright 1990, and Field 1990, and the references to their earlier work, and that of D.R. Hill, there given). See also Turner 1994, chapters 2 and 3 *passim*.
12. Neugebauer 1957, chapter vi, esp. pp.171ff.; al-Biruni; Tester 1987, esp. chapter iv; Saliba 1993.
13. See below, p.272.
14. King 1993b.
15. It must also be noted that medieval Christian Europe had no need to determine either, and that, to some extent, the transfer of knowledge of the astrolabe (and its accompanying astronomy) from Muslim Spain, resulted in the acquisition of knowledge without a purpose, except for its astrological use.
16. See Table 2, below, p.199.
17. On Islamic prayer-times see King 1993b and its useful bibliography.
18. Both in the *Planisphaerium*, which corresponds to the type of astrolabe described here, and in the *Analemma*, which constitutes a form of universal astrolabe. Stereographic projection was used in the dials of Vitruvian anophoric water-clocks of which fragments survive from the period of the 1st to 3rd centuries of our era, also in the lid (formed from the medallion of Antonius Pius, AD 143–4) of a portable sundial datable to the late 2nd century, possibly within a few years of Ptolemy's *Planisphaerium*, *circa* AD160; see Turner 1985, pp.10–11, and the works of Edmund Buchner there cited.
19. Morley 1856; Hartner 1938–9; Michel 1947; North 1974; Turner 1985; Brieux & Maddison, forthcoming.
20. Maddison & Brieux 1974; Maddison & Turner 1976, pp.9, 98.
21. *Cf.* the table of the Lahore family of astrolabists on p.219 below, and that of the family of the maker of astrolabes, and of caskets with combination-locks, published in Maddison 1985, p.149.

22. 'Weathered brass'! On analysis, see Allan 1979, *passim*; see also pp.168 *ff.*, above, for remarks on globes. On trade, see Goitein 1973, esp. pp.192–7, no.39, 'The Indian Bronze Factory of Abraham Yijū'; new or repaired vessels would be sent back.
23. *Cf.* below, cat.135, and the remarks on quadrants, below, p.266.
24. Mayer 1956, p.21, wrote: 'The connection between astrolabists and metal workers in general can be presupposed *a priori*, since ... most of them used to make their astrolabes themselves. This is confirmed by the appellatives of the masters or those of their fathers. Leaving names like *qarasṭūnī* alone, we find some like al-Ibrî [the needle-maker], Ibn an-Naqqâsh [son of the engraver], Saffâr [copper-smith] and Ibn al-Saffâr, or Ibn an-Naḥḥâs [son of the copper-(or brass-)smith], abounding even among those astronomers who are not known as makers of instruments. This worked both ways, since we have also metal objects which are in no way connected with either astronomy or science in general, yet on the evidence of their inscriptions we know that they were made by astronomers (again using the word in a wide sense so as to include all 'time-measurers') or their sons, such as the little bronze jug made by 'Ali b. *muwaqqit* al-Isfîrâ'inî [references given]. Similarly, we read that time-keepers (*mîqâtiyya*) in Yemen constructed an automaton ... [details given]'. Since Mayer wrote, we can add to the miscellany the family of Hamid ibn Mahmud al-Isfahani who, in the 12th century, made astrolabes, strong-boxes with combination locks, and a pen-box, the maker of the last, known only from that one item, calling himself, *al-aṣṭurlābī* (see Maddison 1985, pp.149, 152) and Muhammad ibn Khutlukh (see below cat.120), now known to have made, in the 13th century, a geomantic table and an incense-burner.
25. Chardin 1811, IV, p.332. Chardin left France as a Huguenot refugee. This and the following quotations from Chardin have been translated from the French by the author.
26. Chardin 1811, IV, p.333.
27. Chardin 1811, IV, pp.337–349. See also Michel 1941; 1947, chapter V, *passim*.
28. See Turner 1985, pp.12–14, and references there cited.
29. Although pagans, the Harranians became, by a subterfuge, accepted along with Jews and Christians as 'People of the Book', and were deeply concerned with astrological matters, especially the consideration of the planet, Mercury; and they were reputed to be skilled metal-workers. See al-Nadim – Dodge, II, pp.745ff. esp. 751–3; and below, p.206.
30. Iraqi sources document the trade of *aṣṭurlābī* in the 8th to the 11th centuries; see Shatzmisler 1994, esp. p.114.
31. The purpose of these holes remains obscure. Perhaps they served to accept cords to hold the astrolabe (though an *'ilāqa* is normally attached to the upper ring), or perhaps they are relics of some earlier form of attachment, or ornament. It is interesting that the word, *kursī*, used in Arabic to describe the triangular 'bracket', means 'chair', 'throne', 'base' or 'pedestal', and is used for the stand of a globe; could the original astrolabes have been held by the *kursī* (or a handle attached to it) like an Etruscan mirror? Note that on an astrolabe, as normally held, the cardinal points are placed

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32. Destombes 1960; Maddison 1992.
33. The outstanding exception is the fine work of Abu Bakr ibn Yusuf, of Marrakesh, known to have made at least three astrolabes in the early 13th century; see Mayer 1956, pp.32, 33; Brieux & Maddison, forthcoming, 'Abū Bakr b. Yūsuf'; *cf.* also the comments on Maghribi astrolabe-making in the catalogue of a sale at Hôtel Drouot, Paris, 9–10 October 1980, p.98, no.167.
34. On Balhumal's globes, see below, pp.242–5.
35. It is the second verse of the second *qiṭ'a* of the *Gulistān*; see also the introduction to Maddison & Brieux, forthcoming.
36. Maddison & Brieux, s.v. 'Alī.
37. Levy 1951, p.9; Bausani 1971, chapter VIII, *passim*, esp. p.146.
38. A large astrolabe, 56 centimetres in diameter, now in Deniz Müzesi, Istanbul, made in Damascus in AH 619 (AD 1222–3) for the Ayyubid Sultan, al-Malik al-Mu'azzam Sharaf al-Din (*reg.* 1218–1227) by 'Abd al-Rahman ibn Sinan al-Ba'lbaki al-Najjar, 'calculated by 'Abd ar-Rahman ibn Abi Bakr, the *muqawwim* of Tabriz, inlay by al-Siraj al-Dimashqi (see Brieux & Maddison, forthcoming, ''Abd al-Rahman b. Sinān al-Ba'lbakī an-Najjār'; Maddison 1992d, p.352, where the date appears wrongly); and the astrolabe made for the Safavid Shah 'Abbas II in AH 1057 (AD 1647–8), by Muhammad Muqim al-Yazdi, in the presence (or under supervision) of Muhammad Shafi', the astronomer of Janabad, and engraved by Fadl Allah al-Sabzawari, now in the Museum of the History of Science, Oxford (Mayer 1956, p.74, Muḥammad Muqīm al-Yazdī III; Brieux & Maddison, forthcoming, 'Muḥammad Muqīm al-Yazdī 4').
39. See Table 2, p.199. There are a few differences in the attribution of numerical values from 60 to 1,000 to letters of the alphabet, between the usage in eastern Islam and that in the west (for instance, 60 is *sīn* in the east, *ṣād* in the west).
40. Museum of the History of Science, Oxford University.
41. Nasr 1976, p.121, pl.79 is captioned, 'A contemporary master astrolabe maker of Isfahan'. The photograph is also reproduced in Bergé 1978, p.357.
42. The collection of astronomical and gnomonic instruments formed by Lewis Evans (1853–1930) was the founding collection of the Museum of the History of Science, Oxford University, which began as the Lewis Evans Collection in 1924 and was opened to the public in 1925.

43. The collection of Henri Michel (1898–1981), Brussels, was mostly bought by J.A. Billmeir, and much increased by additions mainly from the collection of Nicolas Landau, Paris; in 1957 it was presented by Billmeir to the Museum of the History of Science, Oxford University. The portion of the Billmeir Collection which came from Michel was described by C.H. Josten (1955). The fake astrolabe was briefly catalogued as an 'Arabian astrolabe, specially designed for astrological purposes' (p.14, no.20); neither signed nor dated, it is now displayed in the Museum as a fake, inv. no.57–84/20.
44. Gingerich, King & Saliba 1972, no.VI (on this group of fakes); p.191 and table 2 (on the ecliptic projection ratio); p.196 (the misuse of *mīdhān* and its pronunciation). The much larger group of crude fakes mentioned above has not been discussed in any publication, but the 'Fakes' files in the series of Islamic instrument files in the Museum of the History of Science, Oxford University, contain numerous photographs, notes of such instruments and letters describing their imperfections. These files also contain material relating to the group of better-made fakes, and to types of fake. However, the number of fakes brought to the attention of the Museum during the last four decades became so great that systematic collating of photographs and notes was not pursued except in instances of particular interest.
45. On the astrolabists whose names were used on the forgeries, see Gingerich, King & Saliba 1972, *passim*, and references given there; see also Maddison & Brieux, forthcoming, ''Abd al-A'imma' and ''Abd al-'Alī'.
46. Quoted in translation in Gingerich, King & Saliba 1972, pp.196, 197, from A. Kržiž, 'Das persisch-arabische Astrolabium des Abdul Aimah', *Das Weltall*, V, 1905, pp.121–30 and 144–52. A genuine astrolabe by 'Abd al-A'immah was considered sufficiently fine and important to be presented in 1866, suitably encased, to the Emperor Napoleon III by Prince 'Aliquli Mirza, the Persian Minister of Public Instruction. It is now in the Observatoire de Paris; see Observatoire 1967, p.74, no.272; Maddison & Brieux, forthcoming, ''Abd al-A'imma II', and references given there.
47. *An Anatomie of the World (The First Anniversary)* (1611) Donne 1946, p.204.

Table 2

Abjad letter-numerals

Eastern & Western			Eastern			Western		
ا	*'alif*	1	س	*sīn*	60	ص	*ṣād*	60
ب	*bā'*	2	ع	*'ayn*	70	ع	*'ayn*	70
ج	*jīm*	3	ف	*fā'*	80	ف	*fā'*	80
د	*dāl*	4	ص	*sād*	90	ض	*ḍād*	90
ه	*hā'*	5	ق	*qāf*	100	ق	*qāf*	100
و	*wāw*	6	ر	*rā*	200	ر	*rā'*	200
ز	*zāy*	7	ش	*s̲h̲īn*	300	س	*sīn*	300
ح	*ḥā'*	8	ط	*tā'*	400	ت	*tā'*	400
ط	*ṭa'*	9	ث	*t̲h̲ā'*	500	ث	*t̲h̲ā'*	500
ي	*yā'*	10	خ	*k̲h̲ā'*	600	خ	*k̲h̲ā'*	600
ك	*kāf*	20	ذ	*d̲h̲āl*	700	ذ	*d̲h̲āl*	700
ل	*lām*	30	ض	*ḍād*	800	ظ	*ẓā'*	800
م	*mīm*	40	ظ	*ẓā'*	900	غ	*g̲h̲ayn*	900
ن	*nūn*	50	غ	*g̲h̲ayn*	1000	ش	*s̲h̲īn*	1000

On the use of the symbol ɛ̄ for zero, see above, p.187

118, folio 173b, detail showing a rete

118, folio 165a, detail showing a suspension ring, a horse, a shackle, a pin, an alidade and a washer

118, folio 171b, detail showing a tablet of horizons

The parts of a planispheric astrolabe

The planispheric astrolabes employed in the Islamic world are known both from surviving examples and from illustrations in technical works. The first are represented here by cat.144, a fine Iranian instrument made in 1650, and the second by cat.118, an exquisite copy of an astronomical treatise produced in India ten years later. The work in question is the *Jāmi' al-mabādi' wa'l-ghāyāt* ('Compendium of principles and objectives'), which was composed by Abu 'Ali al-Marrakushi in Cairo in the early 1280s.

The planispheric astrolabe is a composite instrument made of metal, usually brass. The body of the instrument is the mater, shown here both from the front and from the back. It consists of a disc with a raised rim, or limb, into which the rete and one or more circular plates are fitted.

The five plates of cat.144 are engraved with stereographic projections of the heavens for nine latitudes between 22° and 40° north and with a tablet of horizons. This last gives the horizon at 32 other latitudes and could be used for calculations in which the position of the horizon was the only information needed. It may be compared with the layout for a tablet of eight horizons in cat.118.

The rete is of the same dimensions as the plates, but most of its surface is cut away to produce a net-like celestial map on which a number of brighter stars are indicated by pointers: on cat.144 stars can be located by reference to pointers in the form of stylized leaves. Many other rete patterns are known, as the diagrams in cat.118 show (see also cat.133, for a *zawraq* rete, for example).

The alidade, the sight used for measuring the altitude of the Sun by day and of a given star by night, is placed at the back of the mater. The alidade of cat.144 is shown here with the pin that holds the instrument together, and the wedge, or horse, that holds the pin in place. An illustration in the Marrakushi manuscript shows an alidade (bottom centre), a pin (bottom left) and a horse (top centre), as as a shackle (top left), a ring (top right), and a washer of the type often used to stop the alidade from abrading the surface of the mater (bottom right). The shackle and ring are attached to the roughly triangular bracket at the top of the mater so that the astrolabe can be suspended during use.

144, plate showing tablet of horizons

144, pin, horse and alidade

144, front of mater

144, back of mater

144, rete

144, plates

Using a planispheric astrolabe to tell the time at night

As with the celestial globe, the planispheric astrolabe can be employed in a large number of procedures, including those for telling the time by the Sun and by the stars. The second of these operations has been selected for illustration using cat. 152, an instrument made in Morocco, probably in the city of Meknès, at the beginning of the 18th century.

2 (*above*). Once the plates are in place, the rete is set over them, and the alidade is placed at the back of the mater. The pin is then passed through the hole at the centre of the alidade, the mater, the plates and the rete. Finally, the horse is inserted in the slot in the pin.

3 (*left*). The first stage of the operation is to observe the altitude of a given star, which is done by rotating the alidade, or sight rule, over the back of the mater. The altitude scale of 90° along the edge of the top right quadrant is here used to this end.

On cat. 152 the back of the mater is divided into four quadrants, and the upper two quadrants bear altitude scales of 90°, numbered at intervals of five degrees. A zodiac scale occupies the register immediately within these degree scales, with each of the 12 signs filling a segment of 30°. Within this again, and correlated to it, is a solar calendar scale divided proportionately into the months of the Julian calendar. Using these two scales it is possible to calculate the position of the Sun on the ecliptic from the date according to the Julian calendar.

The centre of the back of the mater is divided in two horizontally. The upper part is occupied by a diagram for unequal hours (usable, in conjunction with the alidade, as a sundial) and a semicircular band containing the signature of the maker and the date of manufacture. The lower section contains a shadow square which allows simple trigonometric measurements for surveying and gnomonic purposes.

1 The astrolabe is assembled for use by putting the plates in the mater, with the plate for the correct latitude on top. The plate selected here is for all towns at latitude 32° 30′ north, according to the inscription at the centre.

Each plate is divided into four quadrants by a vertical north – south line, or meridian, and a horizontal east – west line. South is at the top, West is on the right. The central hole represents the celestial North Pole, and the concentric circles are the Tropic of Cancer, the Equator and, close to the rim, the Tropic of Capricorn.

The plate is occupied by a stereographic projection of the heavens. The base line of this projection represents the horizon at the latitude in question. Above the horizon, and parallel to it, are the almucantars, or circles of altitude, which rise at intervals of three degrees to the zenith of the relevant latitude. Also above the horizon, but perpendicular to it, are the azimuths, which are drawn at intervals of five degrees between the horizon and the zenith.

The area below the horizon is divided by curved hour lines into twelve sections, which are numbered clockwise and represent the unequal hours. The five barbed lines show the times of the Muslim prayers.

5 One of the stars marked on the rete, say Alpha Hydræ (Alphard), is sighted through the alidade: a more accurate reading of the star's altitude can be obtained by taking an average of several observations.

The alidade is equipped with two sight vanes, each with two holes. The larger holes are for observing the position of a star at night, and the smaller for taking the altitude of the sun by day. Stars may be observed by eye, but the sun cannot, and so day-time readings are taken by rotating the alidade until sunlight passing through one hole falls exactly on the other.

4 To take an observation, the astrolabe must hang freely. This is achieved in one of two ways, depending on the size of the suspension ring. Where the ring is large enough, as in the case of cat.152, the astrolabe can be suspended by placing the thumb through the ring. Astrolabes made in Iran and India, such as cat.144 (see pp.200–201), usually have smaller rings and are suspended by gripping a strap or cord that passes through the ring.

6 In this instance, the final position of the alidade gives the altitude of Alpha Hydræ as 36°, according to the scale of degrees in the upper right-hand quadrant on the back of the mater.

7 The rete is then rotated until the tip of the pointer for Alpha Hydræ lies on the almucantar corresponding to the altitude observed, that is, the almucantar for 36°. As the rete rotates, the star pointer touches this almucantar at two positions, one on each side of the meridian – the vertical line that divides the plate into two equal halves. Which of the two is correct is determined by the observed position of the star in the heavens. In this case, the star was to the west of the meridian, that is, to the right of the meridian on the plate.

Star pointer for Alpha Hydrae on the almucantar for 36°

8 Once the rete has been set in the correct position, the time may be read off from the lines of unequal hours engraved on the plate, below the horizon line. A straight line in the form of a thread or rule passes from the centre of the astrolabe, representing the celestial pole, through the position of the Sun in the ecliptic, given here as 18° in the house of Pisces, and cuts the line for the seventh hour. This indicates that seven hours have passed since sunset, and five hours remain till sunrise.

A line drawn from the centre of the astrolabe through the notional position of the Sun, at 18° in the house of Pisces, cuts the line for the seventh hour on the plate beneath the rete.

For many people, the astrolabe must seem to be the characteristic scientific instrument of Islam. More astrolabes survive than any other scientific device; the distribution of astrolabe-making, considered geographically and chronologically, is a tracer of the diffusion of astronomy in Islam; it was an instrument to which many treatises were devoted and which Islamic mathematicians improved and modified for particular purposes; and it was the particular scientific device of which medieval Christian Europe sought to gain knowledge. According to Ibn al-Nadim, who died probably in AH 380 (AD 980–81), after the first astrolabes had been made in Islam, 'then the instruments came to be made in the Syrian city of Ḥarrān [ancient Carrhae]. Later they were distributed, becoming common and increasing in number, so that the work became plentiful for the makers during the 'Abbasid period, from the days of al-Ma'mun [caliph of Baghdad, AH 198–218 (AD 813–833)] to this our own time.'[1]

Ibn al-Nadim says that the first person in Islam to make an astrolabe was the astronomer al-Fazari, who lived in Baghdad in the middle of the second Islamic century, that is, the eighth century of our era.[2] He further gives the names of a number of the early astrolabists, several of whom have the *nisbah* 'al-Harrani' (meaning that the person in question, or one of his immediate ancestors, was 'the man from Harran'). This *nisbah* is found in the names of several scientific scholars who worked in the early centuries of Islam: the famous translator and astronomer, Thabit ibn Qurra, who died in AH 288 (AD 900–1), was originally a money-changer at Harran, while al-Battani, who died in AH 317 (AD 929–30), and who was the renowned author of astronomical tables, was a Harranian. Both men were Sabians, members of a pagan sect which flourished at Harran, and which worshipped the planets, with particular attention to Mercury. It seems that the Sabians used Syriac as a liturgical language, and no doubt their religion was a stimulus to astronomical activity; certainly, the Sabians had Syriac translations of Greek astronomical and other scientific texts, and Harran was a centre for their translation into Arabic, and their diffusion in Islam. The Harranians excelled at metalwork; the quality of their fine balances was proverbial. Here was an ideal place for the manufacture of astrolabes; al-Hamadani, the historian, poet, and astronomer, who died in AH 334 (AD 945), could write: 'Harran is the place where the measuring (sc. observational) instruments were made, such as astrolabes and others'.[3]

The only work known by Thabit ibn Qurra on the subject of the astrolabe is a translation of a treatise by a certain Abiyun al-Batriq, who is mentioned by Ibn al-Nadim. The latter tells us, not without some ambiguity, that in ancient times astrolabes were flat (*musaṭṭaḥa*), that Ptolemy was the first to make them, that it is said that they were made before him, but that one cannot be sure and, finally, that Abiyun was the first to make a plane astrolabe (*saṭṭaḥ al-aṣṭurlāb*). Ibn al-Nadim further says that he thinks Abiyun lived just before or just after the advent of Islam and that among his writings was a 'Book on the construction of the planispheric astrolabe' (*Kitāb al-'amal bi'l-aṣṭurlāb al-musaṭṭaḥ*). The position of Abiyun in the Greek astrolabe tradition remains obscure; the name, *Abīyūn* or *Abywn*, could be Greek in derivation (*Ἀπίον*), or else Coptic; 'al-Batriq' means 'the Patriarch'.

What is clear from his *Planisphaerium*, which only survives in a Latin translation of a lost Arabic translation of a lost Greek original, is that Ptolemy of Alexandria, in the 2nd century AD, already possessed the necessary theory for the construction of an astrolabe, but his instrument may have differed in important respects from existing astrolabes. Ptolemy may also have written another, more practical, treatise on the construction of the astrolabe. In that case his work might be placed more firmly in the tradition of treatises on the planispheric astrolabe in the most common form which we know today. The first Greek treatises describing this form are: a 'Memoir on the small astrolabe [sc. the planispheric astrolabe]' of Theon of Alexandria, who lived in the 4th century AD. This work is lost, but referred to in a Byzantine biobibliographical dictionary of the 10th century AD. This was followed by a treatise written towards the end of the 5th century by Ammonios of Alexandria, which is also lost but is mentioned in the treatise by John Philoponos of Alexandria, whose teacher Ammonios was. A third Greek treatise is John Philoponos' 'On the use and the construction of the astrolabe and on the lines and scales on it', which was written between AD 520 and 550, and of which more than 60 manuscripts survive, dating from the 13th to the 19th centuries.[4] To these Greek treatises must be added the 'Treatise on the planispheric astrolabe' by Severos Sabokht of Nisibis, bishop of Qensherin, written in Syriac about the middle of the 8th century, and which belongs to the same tradition as the treatise of John Philoponos.

Al-Fazari may have been the first Muslim to make an astrolabe, and indeed the earliest surviving astrolabes (though not astrolabe-projections)[5] are Islamic and date from at least a century after his death, that is to say, not before the second half of the 9th century AD. From that time, the manufacture and use of the astrolabe spread throughout Islam, in the east as far as Hindu India, in the west as far as Christian Europe; in Muslim countries, its use continued until the beginning of the 20th century, such was its utility for the determination of the times of prayer and of the azimuth of the qiblah.

In Arabic the astrolabe is called *aṣṭurlāb*, which derives from the Greek ἀστραλάβος or ἀστραλάβου ὄργανον, but has occasioned many etymological fantasies. Like a suitably mounted celestial globe, the astrolabe is an analogue computer which, by simulating the apparent rotation of the stars about the celestial pole, permits the solution of a number of astrological or astronomical problems. The provision of a simple sighting device enables the altitude of a star (or of the sun) to be determined for the solution of certain problems. Ordinary astrolabes are not really suitable for serious astronomical observations, because even the largest are too small to provide accurate results. However, they were useful for finding the time by day or by night, for determining Muslim prayer times, for elementary surveying (by angular measurement), and for teaching by demonstrating the diurnal changes in the sky, the path of the Sun through the ecliptic, the rising and setting of stars, and so on. Astrologers found an astrolabe useful because with it they could ascertain the time and the ascendant; also, although the movement of the planets is not reproduced on an astrolabe, planetary tables enabled the astrologer to know the position of a planet relative to the astrolabe's star-map or to the lines showing the astrological houses, sometimes engraved on the plates. The earliest astrolabes appear not to have had the shadow-square, though the cotangent scale is there. The inscriptions are in a simple, clear, Kufic script, entirely devoid of elaboration, which persists on eastern Islamic instruments until the 15th century. Those astrolabes made before al-Battani's 'Sabian Astronomical Tables' (*al-Zīj al-Ṣābī*) have the old Arabic term for Pisces (*al-samaka*): later the translated Greek name, (*al-ḥūt*), as found in the strongly Ptolemaic tables of al-Battani, is universal.

An example of such an early astrolabe is that made by Ahmad ibn Khalaf, at one time an apprentice of 'Ali ibn 'Isa for a son of the Caliph al-Muktafi (*reg.* AH 289–295 [AH 902–908]). This astrolabe has a rete for 17 stars (*al-samaka* for Pisces) and four plates for eight latitudes; it is now in the Département des Cartes et Plans at the Bibliothèque Nationale, Paris.[6] The earliest astrolabe known to have a date is that signed by a certain *Basṭūlus* (from the Greekἀποστολος) or *Nasṭulus* (? the Nestorian) in AH 315 (AH 927–8).[7] The maker, an apprentice once removed of 'Ali ibn 'Isa, is mentioned several times in the *Fihrist* of Ibn al-Nadim, but the garbled spelling of his name has obscured the identity of the references; he was also referred to by al-Biruni as being concerned with a device for calculating eclipses and as the deviser of an unusual astrolabe rete. The astrolabe, now in the Dar al-Athar al-Islamiyya, Kuwait, has a single plate engraved for latitudes 33° (probably for Damascus and Baghdad) and 36° (perhaps for Harran).

1. al-Nadim–Dodge, II, pp.670–1.
2. al-Nadim–Dodge, p.649, but compare the reference to Abiyun al-Batriq (II, p.670) which – probably wrongly – determines Abiyun's religion and contradicts the reference to al-Fazari.
3. Wiedemann 1926–7, pp.131–2.
4. See Philopon in the superb edition by A.-P. Segonds.
5. See above, pp.197–8, note 18.
6. No.Ge.A.324; see Brieux & Maddison, forthcoming, 'Aḥmad b. Khalaf'.
7. See Maddison & Brieux 1974; Maddison & Brieux, forthcoming, 'Basṭūlus'. For the earliest astrolabe-makers, see Saliba 1991, esp. p.111.

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Suspension bracket

Perhaps Mosul or Damascus, 13th century

Brass, cast and engraved
maximum height 30.2 cm
maximum length 49.4 cm
maker Shakir ibn Ahmad
accession no. MTW 825

This large suspension bracket, or *kursī*, from a frame of foliate pattern and cast *à jour*, is very finely made. In the lower, centre part, a palmette-shaped cartouche is engraved on one side in a *naskh*-based script, with the signature of the maker, Shakir ibn Ahmad.[1] The piece was meant to be seen from both the front and the back, because the finish on both sides is the same. The underside of the bar at the base of the bracket has a groove, 47 centimetres long, symmetrically disposed along most of its length between bevelled edges, terminating in a horizontally pierced flange at each end; in the centre of the groove there is a vertical hole. These features presumably served to attach the bracket to whatever it was designed to support.

The bracket's design recalls the very similar, but smaller, bracket on the geomantic plate by Muhammad ibn Khutlukh al-Mawsili, dated AH 639 (AD 1241–2), in the British Museum.[2] Despite his *nisbah*, and the style of the work, the geomantic plate may have been made in Damascus: an undated incense-burner by Muhammad ibn Khutlukh, now in the Aron Collection, is signed by him as made in Damascus (... *bi-Dimashq*). Indeed, before Mosul was sacked by the Mongols in AD 1261, several metalworkers had already left the city in quest of the patronage of the courts of the Ayyubid sultans (in Damascus until AD 1260). According to Rachel Ward, the geomantic plate and the incense burner 'suggest that there was a casting workshop in Damascus that was capable of unusual and complex work'.[3] In style, the bracket also resembles the pair of door-handles probably from Mosul, which are in a private collection in Kuwait.[4] Private information has suggested that this bracket once supported a rectangular frame in which was suspended a celestial globe, which, after its removal from the frame, was sold by a Parisian dealer to a client in the United States of America; it has not proved possible to confirm this, but the suggestion is not implausible because the geomantic plate, which is 33.7 centimetres in length, has a bracket only 5.4 centimetres high, and a heavy globe in a larger frame might be expected to require a much larger bracket, if only for stylistic reasons. The corresponding globe, if indeed it does exist, would have to be of substantial size – not less than 30 centimetres in diameter – and similar in style and date to that made in AH 674 (AD 1275–6) by Muhammad ibn Hilal al-Munajjim al-Mawsili, now in the British Museum.[5] The list of globes published by Emilie Savage-Smith in 1985 does not, however, include any such globe in the United States.[6]

The scientific content of the text on nearly all globes, and indeed other scientific instruments, made before the 16th century is inscribed in Kufic, not *naskh*, script,[7] but the use of *naskh* on this *kursī* does not imply that the same script was used on an accompanying globe, and it should be recalled that the geomantic table by Muhammad ibn Khutlukh has both.

1. Brieux & Maddison, forthcoming, 'Shākir b. Aḥmad'.
2. British Museum, inv. no. 1888.5–26.1; see Savage-Smith & Smith 1980, *passim*, esp. pp.15–18; Brieux & Maddison, forthcoming, 'Muḥammad b. Khutlukh al-Mawṣilī'.
3. Ward 1993, p.84; Allan 1986, no.1, and Chapter Two, 'Muḥammad ibn Khutlukh's Incense-burner and the History of Incense-burners in the Near East in Early Islamic Times'.
4. Louisiana 1987, no.96 and p.13.
5. British Museum, Department of Oriental Antiquities, inv. no.71.3.1; Savage-Smith 1985, pp.219, 220, no.4.
6. Savage-Smith 1985, *passim*.
7. Savage-Smith 1985, pp.213, 214; *cf.* Destombes 1960.

120, detail

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Plate from a planispheric astrolabe

Syro-Egyptian, 13th century

Brass sheet, beaten and engraved
diameter 17.5 cm
accession no. SCI262

This characteristic astrolabe-plate is engraved with the usual stereographic projection of the celestial sphere on both sides. On the side of the plate drawn for latitude 30° (see below), the part-circles above the horizon-line (inscribed *al-maghrib*, 'west', on the right, and *al-mashriq*, 'east' on the left) are almucantars or circles of altitude drawn for every three degrees of altitude; on the other side of the plate, where the latitude inscription is illegible through corrosion, the part-circles are azimuths, that is, angles measured along the horizon, drawn for every five degrees. Below the horizon on the side for 30° are lines for determining unequal hours, those whose length is calculated by dividing the interval between sunrise and sunset or between sunset and sunrise by twelve, midday and midnight being six o'clock; although the hours are equal to each other during any twelve-hour period, their length varies through the year, and day and night hours are only equal at the equinoxes. On the other side, the hour-lines are for Italian hours (*horae ab ortu solis*), equal hours numbered from the first hour after sunrise to the following sunrise. Between the horizon and the hour-lines, the latitude (*'arḍ*) is given on the right of the vertical meridian line in *abjad* numerals, letters of the Arabic alphabet apportioned numerical values: /l/ ('30 [degrees]'); the inscriptions on the other side are now illegible. To the left of the meridian is the word *ṣā'āt* ('hours') and, below, in *abjad* numerals, /yj/ ('13 [hours]'): /yh/ ('18 [minutes]'), the hours being to the right of the meridian, the minutes to the left. These times give the length of daylight, on the longest day, in the latitude for which that side of the plate is drawn.

The *abjad* numerals are in a simple Kufic script, often found on the earlier eastern Islamic instruments, and sometimes called 'astronomical Kufic'.[1] Its slightly elongated form most resembles that on a number of Ayyubid or Mamluk instruments from the Syro-Egyptian region.[2] Being in Kufic script, in which diacriticals are rarely shown, it is necessary to distinguish between the *abjad* numerals 3 (/j/) and 8 (/h/); this is done by writing the former without a tail. This distinction occurs in the numeration of the hours of daylight in 30 degrees of latitude and in the numeration of the unequal hours, which begins below the words *al-maghrib* with *alif* = 1, and continues clockwise to /yb/ = 12.

At the bottom of the plate, on both sides where a notch for a retaining lug might be expected, there is a riveted knob, which was presumably a later addition.

1. See Destombes 1960.
2. See Maddison 1992d.

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Rete and a plate from a planispheric astrolabe, or an astrolabe-clock

Perhaps Isfahan, *circa* AH 620 (AD 1223–4)

Brass sheet, cut and engraved
diameter 12.6 cm
maker Muhammad ibn Abi Bakr ibn Muhammad Rashidi
accession no. SCII
provenance Alain Brieux, Le Val Germain

The rete is very unusual and may be unique among known Islamic astrolabes. The bounding circle does not represent the Tropic of Capricorn (it does not touch the ecliptic circle), but is a complete, and arbitrary, band beyond where the Tropic would normally be (*cf.* cat.126). This enabled the maker to cut his signature in silhouette, with some engraved detail, along the inner edge of the band, beginning on the right, just below the knob for turning the rete, which was placed at the extreme right-hand end of a horizontal band. The only other known rete with similar characteristics appears to be that of a Latin astrolabe of *circa* 1400, in the Museum of the History of Science, Oxford University.[1] The edge of this latter rete is cut with 120 gear teeth, which have no function in relation to the astrolabe with which it is now associated but which suggest that it may have begun as the rete of an astrolabe-clock. If Muhammad ibn Abi Bakr's rete were not part of an astrolabe water-clock, it seems at least probable that it was part of an astronomical instrument, the back of which provided no space for a signature.[2]

The accompanying plate, notched to prevent it turning in some sort of mater or recess, is engraved on one side with a normal stereographic projection for latitude 32°, and on the other for latitude 34°. The azimuths are engraved below the horizon-line, and there are lines for unequal hours. To match the rete, the plate extends beyond the circle representing the Tropic of Capricorn, as does the plate of the Latin astrolabe in Oxford, mentioned above.

The maker has taken advantage of the extension beyond the Capricorn circle of both rete and plate to make the unusual inclusion, on the rete, of two stars outside, that is, below, the Tropic of Capricorn. There are 12 stars within the ecliptic circle, 25 outside but within the Capricorn circle.

The maker of these two astrolabe elements, Muhammad ibn Abi Bakr ibn Muhammad al-Rashidi al-Ibari ['the needle-maker'] al-Isfahani, who may have died in AH 629 (AD 1231–2), also made in AH 618 (AD 1221–2) the unique astrolabe with a geared calendar-movement, now in the Museum of the History of Science, Oxford University, his only other known work.[3]

1. Inv. no.57–84/175A; Maddison 1957, pp.32, 33, no.175A, and pl.XXIV.
2. If, for example, it was engraved with a universal projection of the celestial sphere.
3. Inv. no.IC5; Maddison & Turner 1976, ff.112^r–114^r, nos 52, 53; and Brieux & Maddison, forthcoming, 'Muḥammad b. Abī Bakr ar-Rāshidī 1', for many references, especially those cited in note 11 of the introductory essay on astrolabes, p.197, above. He is sometimes wrongly confused with the astronomer, musician and doctor, Abu 'Abdallah Muhammad ibn Abi Bakr al-Farisi, who died in AH 677 (AD 1278–9).

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122, plate

122, rete

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Celestial globe

Iran, dated AH 684 (AD 1285–6)

Brass
diameter 13.4 cm *weight* 1.30 kg
maker Muhammad ibn Mahmud ibn 'Ali al-Tabari al-Asturlabi
accession no. SCI21
comparative item Paris, Musée du Louvre, Section Islamique, inv. no. 6013
published Savage-Smith 1992a, pp. 56–7 and fig. 2.37.

This precisely executed globe, formed of two metal hemispheres, is the sixth oldest surviving celestial globe. The maker's name is given twice on the globe, as Muhammad ibn Mahmud ibn 'Ali al-Tabari and as Muhammad ibn Mahmud al-Asturlabi. In the second inscription the maker omits the name of his grandfather as well as his *nisbah*, al-Tabari, but emphasizes instead his trade as an astrolabe-maker. And indeed the globe – unfortunately missing its stand and rings – does reflect the work of a professional instrument-maker.

Nothing is known about the maker of the Khalili globe, though the name suggests an origin in Tabaristan, a province in northern Iran on the southern shore of the Caspian Sea. There is no town by the name of Tabar, and most bearers of the *nisbah al-Ṭabarī* came from the provincial capital of Amul.[1]

One other instrument probably made by same man is known. It is a small, undated brass horary quadrant, with a radius of 6.5 centimetres, signed 'Made by Muhammad ibn Mahmud'.[2] It was purchased by the Metropolitan Museum in New York in 1935 during the Museum's excavations at Nishapur, but it is not clear whether or not it was found in the excavations. The quadrant is engraved on one side only, in Kufic script (like the globe), and its attribution to the same maker seems reasonable. It is one of the two earliest Islamic quadrants so far recorded.[3]

Two astrolabes made by the maker's father, Mahmud ibn Ali, have been recorded, but are now lost. One, signed by Mahmud ibn 'Ali ibn Yusha', al-Tabari is dated AH 669 (AD 1270–1), and also bears equivalent dates in the Malikshah, Yazdegerd and Alexander eras. It carries a dedicatory inscription to al-Hasan ibn 'Ali al-Shadid.[4] The second astrolabe was signed Mahmud ibn 'Ali al-Tabari, dated AH 675 (AD 1276–7), and dedicated to Sharaf al-Din Uthman ibn 'Umar Rizqabadi, 'sovereign of learned men and geometers'.[5]

The globe is formed of two hemispheres of quite a pure brass, with a wall thickness of about 3 millimetres. The seam lies along a great circle perpendicular to the ecliptic – that is, the ecliptic latitude-measuring circle which passes between the Houses of Taurus and Gemini and between the Houses of Scorpio and Sagittarius. The ease with which the sphere has apparently been dented would suggest that it was made from raised or beaten hemispheres rather than cast ones.

Engraved on it are six ecliptic latitude measuring circles, and the ecliptic and celestial equator, the latter two graduated by single degrees with every fifth degree labelled in *abjad* letter-numerals. The ecliptic repeats the numbers every 30°, while the equator is numbered in three segments of 100° and one of 60°. The graduations are very uniform and the great circles precisely executed. Holes have been drilled at the celestial poles, with smaller ones at the ecliptic poles. About 1022 stars are indicated by small inlaid silver points, some now tarnished or missing. The north celestial pole, the 12 zodiacal houses, 55 stars, 28 lunar mansions, and 32 of the constellations are labelled.

All the labels and the signature inscriptions are engraved in Kufic script without diacritical points, except for a five-line signature which has full diacritical points. Placed near the south pole, it reads:

'These stars were drawn from the *Book of Constellations* by Abu'l-Husayn al-Sufi, after increasing their longitudes 5 degrees to correspond to our time, [leaving] the correction of whatever inadvertent errors have occurred in it and the orthographical mistakes[6] to those who are compassionate.[7] And that is in the year 684, and the inscriptions[8] [are by] Muhammad ibn Mahmud al-Asturlabi.'

The reference, of course, is to the *Kitāb ṣuwar al-kawākib al-thābitah* ('Book of constellations of the fixed stars') by 'Abd al-Rahman al-Sufi, a 10th-century court astronomer in Isfahan (see above, pp. 169–70). The artistic conventions of dress and hair styles of the constellation figures on the globe have been made to correspond to those of late 13th-century Iranian art under the Ilkhanids.

The longitudes of the stars near the ecliptic are for the most part well-positioned for a globe produced in the last quarter of the 13th-century using the catalogue of al-Sufi with suitable increments. Many of the stars located at a distance from the ecliptic, however, are not as well placed and do not correspond to the positions stated or illustrated in the treatise by al-Sufi. In addition, the total number of stars on the globe is at variance with that in al-Sufi's catalogue. The 'overlooked star' in the middle of the tail of Ursa Major, mentioned by al-Sufi but not included in his catalogue, is represented and labelled on the globe, while the six external stars of the Southern Fish (*Piscis Austrinus*) are omitted from the globe even though al-Sufi included them. Furthermore, in a few constellations the number of stars inlaid on the globe are in error. For example, Draco has only 26 instead of the required 31 and Corona Borealis has none at all.

The unreliability of the position of the stars far from the ecliptic as well as the variation in the number of stars is inconsistent with the general accuracy and precision of the rest of the instrument. The question thus arises as to how many artisans would have been involved in its production. In the shorter of the two maker's inscriptions the globe is said to be the 'work' (*ṣan'ah*) of Muhammad ibn Mahmud, and by using a noun – roughly equivalent to the Latin *opus* – the maker might have intended to indicate that he actually constructed the sphere or was responsible for the design of the globe in terms of laying out the great circles and graduations. In the longer signature, he claims responsibility for the inscriptions (*kutub*), by which he apparently intended to indicate that he engraved all the inscriptions. Whether he also placed the stars on the sphere and engraved the constellation outlines is not, however, clear. The stars are indicated by small silver points inlaid into pre-drilled holes; this involved a different metalworking technique from engraving, and it is likely that one person in the workshop specialized in placing the stars.

It is also noticeable that the circles and lettering are fairly deeply incised, while the constellation figures are indicated by finer and lighter lines – a combination of techniques in keeping with much of the craftsmanship on other early globes. The more delicate engraving might suggest that another specialist craftsman was involved. Thus it is possible that at least three different artisans worked on this one product.

Apart from the positioning of the stars distant from the ecliptic, al-Tabari's globe is a precise instrument which gives the impression that it was intended to function as a scientific instrument rather than as a decorative curiosity for a benefactor or potentate. Nevertheless, the surface of the globe shows no signs of having been rubbed or scraped by rings. Either the rings were so well made as to produce no abrasion, or the globe was little used, or possibly removed from the rings soon after its construction. Aggressive cleaning may, alternatively, have removed evidence of abrasion.

A nearly identical globe, with the same date and maker's name, has been in the collections of the Musée du Louvre in Paris since the end of the last century, but it can now be shown to be a 19th-century copy made by a metallurgical technique characteristic of later Indo-Persian products.[9] Its poorly formed Kufic script and spelling errors, as well the inaccuracy of its graduations and technical features, contrast sharply with the Khalili

123, detail of the signature

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globe, which surely served as the model for the artisan who produced the Louvre example. A detailed study and comparison of these two globes is to be published elsewhere.

It is worth noting the 'Indian' connections of the globe and of the two astrolabes made by Muhammad ibn Mahmud's father. Cat.123 was allegedly brought from India for sale in London. The copy of the globe, now in the Louvre, was bought in Cairo in 1892, but its method of manufacture indicates that it was made in India. The astrolabe dated AH 669 (AD 1270–71) was acquired in Benares (Varanasi) before 1856 by a 'Professor Wilson', so that it is sometimes referred to as 'Professor Wilson's astrolabe'. The mater was engraved, or possibly re-engraved, with a gazetteer of Indian towns and their latitudes, in *nāgarā* script. Wilson is probably the orientalist Horace Hayman Wilson (1786–1860), who began his career as a surgeon for the East India Company, and became Professor of Sanskrit at Oxford in 1832.[10] The mater of the astrolable dated AH 675 (AD 1276–7) was engraved with an astrological table, using Hindu-Arabic numerals; this may have been a re-engraving, but it should be stressed that the Kufic letters of the names of the signs of the zodiac in the headings of the table are almost identical to those of the *abjad* numerals on the limb. The original rete had been replaced by an Indo-Persian (Mughal) rete, probably of the 17th century; the plates were missing.

That three instruments made by Mahmud ibn 'Ali and his father should have reached India may suggests that members of the family travelled there.

1. For the *nisbah*, *al-Ṭabarī*, see Heffing 1934; Barthold 1984, pp.238–42. The name al-Tabari should not be interpreted as referring to the town of *Ṭabarīyah* (Tiberius) in the Lebanon, for the *nisbah* of someone from there is *Ṭabarānī*.
2. New York, Metropolitan Museum of Art, acc.no.36.20.54. See Mayer 1956, p.71; Maddison & Turner 1976, p.151, no.70; Brieux & Maddison, forthcoming, 'Muḥammad b. Maḥmūd aṭ-Ṭabarī 2'.
3. The other horary quadrant, of similar radius (5.9 centimetres), but with a slightly different arrangement of the scales, inscribed for latitude 30°, is signed 'Made by Sa'du ibn 'Ali, *al-mua'ddhin* ('the muezzin'). It is also undated and is now in a private collection in Kuwait; see below, p.266. See Maddison & Turner 1976, p.151, no.71; Brieux & Maddison, forthcoming, 'Sa'dū b. 'Alī'. The dates proposed in Maddison & Turner are 11th or 12th century AD, but these dates were estimated solely on stylistic grounds, and are not immune from revision.
4. An astrolabe with a diameter of approximately 9.5 centimetres. Brieux & Maddison, forthcoming, 'Maḥmūd b. 'Alī at-Tabarī 1'. Morley (1856, pp.32–4) gives details of this astrolabe and its inscriptions, arguing that the dedicatee was chief vizier of the Mamluk Sultan Baybars; for further bibliographical references, see Brieux & Maddison, forthcoming.
5. This smaller astrolabe, with a diameter of 8.4 centimetres, was sold at the Librairie Alain Brieux, Paris, before 1971, and its present location is unknown. See Brieux & Maddison, forthcoming, 'Maḥmūd b. 'Ali aṭ-Ṭabari 2'. The dedicatee remains unidentified.
6. Reading *taṣḥīf*, meaning the misplacement of diacritical points or the production of alternative readings; see Steingass 1892, p.304; Dozy 1881, I, p.820.
7. The word as written on the globe reads *mutaraḥḥimīn* meaning 'those who are compassionate'. The maker of the Louvre copy has supplied a diacritical point, so that the word reads *mutarjimīn*, meaning translators or interpreters. The latter was no doubt a more familiar word to the maker of the Louvre globe, but it does not assist the sense of the passage.
8. Reading *kutub* as a noun meaning in this case 'inscriptions'; see Dozy 1881, II, p.442, and Ullmann 1970, I, p.40. Unfortunately the word *k-t-b* is written where the hole bored at the south celestial pole cuts off the end of the final letter. It is tempting to read this as the passive *kutiba*, but unlike English and other Indo-Euroean languages, in Arabic the passive cannot be used when the doer of the act is mentioned. Consequently, it must be read either as the noun *kutub* or it must be assumed that a personal suffix was attached to the word (reading *katabahā*); there does not, however, seem to be sufficient space for this rendering. See also Paul Kunitzsch in a book review in *Der Islam*, 64,1987, p.370, who argues that the nearly identical inscription on the Louvre globe should be read as *kataba*.
9. Paris, Musée du Louvre, Section Islamique, inv.no. 6013; see Savage-Smith 1985, pp.220–21, no.6 and pp.27–9, where some of its questionable features were discussed prior to the discovery of the globe now in the Khalili Collection. The inscriptions given by Savage-Smith for the Louvre globe were based on the text printed in Cassanova 1892, p.319, and in Combe, Sauvaget & Wiet 1944, pp.44–5, no.4864. Later examination of the globe indicated that two words had been omitted in the transcription.
10. An alternative, but less probable, identification would be John Wilson (1804–75), missionary and orientalist, who became Dean of the Faculty of Arts in Bombay University in 1857. For both these Wilsons, see *Dictionary of National Biography*.

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Planispheric astrolabe inscribed in Judaeo-Arabic

Probably Spain, *circa* 1300

Brass, cast and sheet, cut and engraved; the rete set with silver studs, some now missing
diameter 18.5 cm *maximum height* 22 cm (excluding the shackle and suspension ring) *thickness of mater* 1.1 cm
maker Abraham
accession no. SCI158
provenance Dr Tommaso Franco, Vicenza, Italy
published Christie's, Amsterdam, 15 December 1988, lot no.247;[1] Berlin 1992, no.12/17.

Astrolabes inscribed in the Hebrew script are very rare. Indeed, apart from a number of crude modern fakes, only four are known, including this example. One of the other specimens, which is in the British Museum, may date from the mid-14th century;[2] another, in the Kugel collection in Paris, from the mid-15th century;[3] and the third, in the Adler Planetarium in Chicago, from the mid-16th century.[4] All three can be presumed to have been made in non-Muslim Europe, as in their quatrefoil Gothic design they resemble contemporary instruments with Latin inscriptions. Cat.124 is therefore unique, as it was made by a member of an Arabic-speaking Jewish community.[5] The maker's client seems to have intended to use the astrolabe in Tunis, Seville and Córdoba, and perhaps also in Sijilmasah, Marrakesh, Cairo and Jerusalem, and the rete is set with the silver studs characteristic of astrolabes from Islamic Spain and the Maghrib (compare cat.152, 153 and 163). It therefore seems reasonable to attribute the piece to Spain or North Africa. At the same time a consideration of the vernal point in the zodiac/calendar scale on the back, of the star positions on the rete, and of the general style of the astrolabe suggests that it was made as early as the turn of the 14th century.[6]

The rete indicates 26 stars, 13 within the ecliptical circle and 13 outside it. Each star is named and is indicated by a simple triangular pointer with one or three silver studs at its base. Four additional studs were arranged symmetrically on the upper part of the rete.

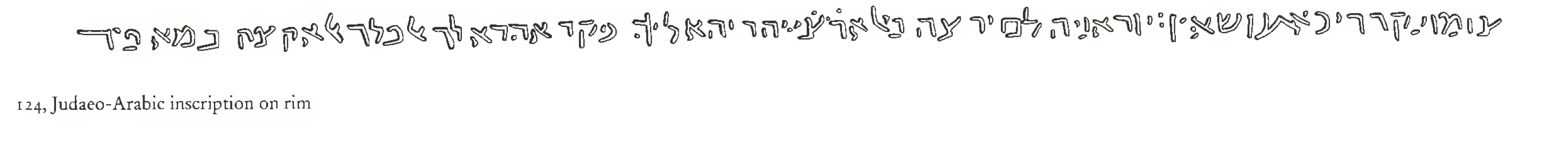
The three plates are engraved with almucantars at intervals of five degrees and azimuths at intervals of ten degrees, the Equator, the Tropics and the lines of unequal hours; these last are numbered in words. The plates are inscribed in the centre, below the horizon line, with the latitude for which they were made. One was intended 'for the latitude of Sijilmasah, 29°' on one side and 'for the latitude of Marrakesh, 31°' on the other; the second 'for the latitude of Cairo, 30°' and 'for the latitude of Jerusalem, 32°'; and the third 'for the latitude of Seville, 37°' and 'for the latitude of Córdoba, 38°'. The small projecting lugs that prevented the plates from turning within the mater are now missing (as are the alidade, horse and pin). The Hebrew script on the first and second plates is less tidy than that on the mater and the rete, and they may be by a different hand, but the script on the third plate, for Seville and Córdoba, is all but identical; this plate is therefore probably contemporary.

The *kursī*, which has engraved arabesque decoration, was made separately from the mater and was soldered on, perhaps in the course of a repair. The associated shackle has similar decoration. The inside of the mater is engraved as a plate 'for the latitude of Tunis, 37°', while the scale of 360° on the limb is numbered anti-clockwise at intervals of five degrees. On the back, within four quadrants of degrees marked at intervals of five degrees from the east – west line, there is a scale by which the signs of the zodiac could be correlated with the solar months of the Julian calendar and, approximately, with the lunar months of the Jewish calendar (0° Aries = 14 March/Adar); a form of perpetual almanac; and half a shadow square. Around the side of the rim there is a long inscription in Judaeo-Arabic, one of the types of Middle Arabic used by Jewish communities and written in the Hebrew script.[7]

Middle Arabic was a form of literary Arabic based on a vernacular but influenced by the classical standard. It was usually employed by non-Muslim populations of the Arab world, who were free of the pressure to conform rigidly to the classical language felt by Muslims, and, as there was no universally respected model, Middle Arabic varies from example to example, as does the orthography. On this astrolabe, for example, the names of the signs of the zodiac are spelt differently on the rete and on the mater, although they appear to be in the same hand. The inscription on the rim is difficult to interpret, but it appears to have been addressed by the maker to the user, 'May it show to you the things which need to be paid attention to, in ... that you are great who have lifted it. But your servant Abraham ... your fate from something ... was not satisfied with the country it shows you, [for] it has shown you the furthest star by means of its content.'[8]

The rarity of astrolabes inscribed in the Hebrew script may reflect the less prominent role the instrument played in Jewish astronomy and in Jewish culture in general, but there are medieval Jewish treatises on the astrolabe, such as that written by Abraham ibn 'Ezra in AD 1146–8.[9]

1. The description that follows is based on that in the Christie's catalogue.
2. Formerly in the Spitzer Collection, Paris; see Gunther 1932, I, p.304, no.158; Goldstein 1976, p.251, n.2 *et passim*; Gibbs, Henderson & de Solla Price 1973, no.158.
3. Bandeira Ferreira 1964; Gibbs, Henderson & de Solla Price 1973, no.3906; Goldstein 1976.
4. Formerly in the Mensing Collection, Amsterdam, inv. no.M20; see Engelmann 1924, p.13, pl.6, no.M20; Gunther 1932, II, p.304; Gibbs, Henderson & de Solla Price 1973, no.1591; Pingree, forthcoming. The date is that proposed by Goldstein, but the quatrefoil Gothic rete would suggest it is earlier.
5. There is an unfinished rete on an *andalusī* astrolabe of slightly earlier date and made by Muhammad ibn Sahli in Valencia in AH 483 (AD 1090–91) in the National Museum of American History, Smithsonian Institution, Washington, DC, inv. no. 318 178; Gibbs with Saliba 1984, pp.174–7, and figs 115–17; Gibbs, Henderson & de Solla Price 1973, no.2572. See also Brieux & Maddison, forthcoming, 'Muḥammad b. as Sahlī I'; Goldstein 1976, p.251, n.1; Goldstein & Saliba 1983. For an astrolabe on which the zodiacal and month names have been duplicated in Hebrew without obliterating the Arabic, see Goldstein & Saliba 1983, p.20, n.4.
6. It should be noted that at this date Seville and Córdoba were already under Christian rule.
7. Blau 1988; Hary 1996; Wexler 1996, *passim*.
8. The text displays typical Judaeo-Arabic features such as the pseudo-correct use of the classical negation *lam*, asyndetic relative clauses, plurals not designating persons referred to by the plural, and unusual retention of case endings; see Blau 1966–7, § 203, 356, 185, 216 respectively. This discussion is entirely dependent on the details given by M.J. Brown in the Christie's sale catalogue (see above, note 1). An alternative reading has been supplied for the present catalogue by Dr Geoffrey Khan: 'People in need granted [this] to you as a gift and celebrated in a great festival ... But your servant Abraham Ḥen saw that your power transcended what is seen. He was not satisfied with the earth and gives you it as a gift, by which also far-reaching dominion has been given to you.' See also Brieux & Maddison forthcoming, 'Abraham'.
9. Solomon Gandz (1927) published the Hebrew terminology for the astrolabe and its component parts. In general, see *Encyclopaedia Judaica*, III, cols 786–807; Steinschneider 1964; and Berlin 1992, pp.269, 270, no.12/18.



124, Judaeo-Arabic inscription on rim

124, mater, plates and rete

124, mater

124, rete

124, plate

124, plate

124, plate

125

Mater of a planispheric astrolabe

Probably Iran, 14th century

Brass, cast and sheet, engraved
diameter 15.7 cm
maximum height 17.5 cm
(excluding suspension ring)
accession no. SCI3

The mater has a cast rim with an integral *kursī*, which retains the two unexplained holes characteristic of the earliest Islamic astrolabes; the backplate is riveted on. The sole decoration consists of borders of plain double lines around the edge of the limb, the *kursī* and the holes, on both sides.

The limb is engraved with a scale of 360° marked at intervals of five degrees clockwise from the top of the instrument. The *abjad* numbering proceeds from [0°] to 100° three times and then [0°] to 60°, in the sequence /h/ = 5°, /y/ = 10°, /h/ = [1]5°, /k/ = 20°, /h/ = [2]5°, and so on. The inside of the mater is engraved with a quadripartite tablet of horizons for 40 latitudes, the horizons disposed in eight groups of five, according to the final digit (17, 27, 37, 47, 57; 18, 28, 38, 48, 58; and so on). All the notations on the front of the instrument are in the variety of 'Eastern Kufic' script sometimes known as 'astronomical Kufic', which ceased to be used *circa* 1500.[1]

The back is divided into four quadrants, which contain an unequal-hour diagram, inscribed '... for all latitudes' (upper right); a sine quadrant (upper left); and a shadow square within scales of cotangents (lower right and left). The notation on these is in a sketchy *naskh* hand, which may indicate that they are later additions, perhaps Ottoman. The surrounding scales are in 'astronomical Kufic'. The scales in the two upper quadrants are divided into 90° and notated at intervals of five degrees, anticlockwise in the case of the upper right quadrant and clockwise in the upper left.

1. Note that /ḥ/ = 8 is distinguished from /j/ = 3 by a short retroflex tail, a feature of Kufic *abjad*.

125, front

125, back

Indian (Mughal) astrolabes[1]

The development of astrolabe-making in Muslim India appears to be associated with the reign of the Mughal emperor Muhammad Humayun (*reg.* 1530–40; 1555–6), the son of Babur, the Timurid conqueror of northern India, almost certainly as a result of the King's personal interest in astronomy and astrology. According to Mulla Badawni, Humayun 'was matchless in the science of astronomy, astrology and all other strange arts';[2] this is confirmed by Ferishta, who says that 'He had much proficiency in mathematics, always associated with scholars and the learned, and constant discussion on learned topics took place in his presence.'[3]

Humayun learnt astronomy from Ilyas Ardabili, and during his temporary exile in Iraq and Iran took lessons from other scholars; he himself gave lessons in mathematics and astronomy, and had 'extraordinary interest and proficience in the use of the astrolabe, globe, and other instruments of the observatory…'[4] Humayun's sister described how the king himself fixed the auspicious time for a wedding: '… in the month of Jumada I, AH 948, at Yatur on Monday at noon, His Majesty the King took the astrolabe in his hand and fixed the fateful hour.'[5]

The work of the king and the functions of the court were organized on an astrological basis. Humayun died, it is reported, from falling down the stairs of his library, which had been converted from a three-storey bastion so that it could be used for an observatory. He had been hurrying down the stairs after the evening call to prayer interrupted a discussion he was having with some mathematicians, while awaiting the appearance of the planet Venus.[6]

One, at least, of Humayan's instrument-makers was Mawlana Maqsud Hirawi, who 'was one of the devotees of the Resident of the Paradise [i.e.Humayun] … He manufactured astrolabes, globes, in such a manner that the observers of his works were wonderstruck.'[7]

However, nearly every surviving astrolabe and globe from Muslim India which is signed was made in Lahore by one of several members of the same family. Unsigned Islamic instruments which appear to be of Indian origin can often be attributed to their workshops. The earliest member of this family mentioned in the *nasab* (pedigree) of the signature of any of these astrolabists is a certain *ustadh shaykh Allāh-dād* (or possibly *Ilāh-dād*),[8] who is always characterized as *asṭurlabī Humāyūnī Lahurī* ('the Humayun astrolabist of Lahore'), presumably meaning that Allah-dad was in some way patronized by or associated with the royal court.[9] The genealogical table below shows the relationship of the descendents of Allah-dad who continued to work as astrolabists through most of the 17th century.[10] The work of Allah-dad himself is free of elaborate decoration, accurate, and shows a wish to make his astrolabes as useful as possible by including a variety of scales and tables. In many respects, his work resembles that of the earliest and less ornate astrolabes made when astrolabe-making was revived in Iran in Safavid times, and a connection may be suspected.[11]

The work of his descendants shows a certain elaboration in style, but never any lavish decoration of the sort characteristic of Safavid Iranian instruments. On the Indo-Iranian Mughal astrolabes, the tracery of the rete is usually complex, not so much because of the intricacies of the floral pattern, but because of the number of stars represented. The *kursī* is nearly always high and worked *à jour*, in contrast with the usually solid design on a Iranian astrolabe. The Lahore makers not only came to make astrolabes with a very full complement of plates for different latitudes, but added to the plates azimuth lines which are drawn below the horizon, and lines for Babylonian and Italian hours as well as the usual unequal hours. The back is filled with scales and tables, and the graphs of meridian altitudes of the Sun, plotted on equidistant, as opposed to stereographically projected, arcs of the signs of the zodiac, assume a characteristic sigmoid shape, which appears to be diagnostic of Mughal astrolabes.

The few known instruments with unusual rete patterns also come from the Lahore astrolabists. These makers usually sign in or above the shadow-square, but not in a cartouche; dates are often given in the Alexander and Yazdegerd eras as well as that of the Hijra.

There are a few 17th-century and later astrolabes from Muslim India which are not the work of the Lahore workshops, but none earlier.[12] Al-Biruni says that, while in India, he taught the (Hindu) pundits the use of the astrolabe. This may be the reason why most of the surviving Hindu astrolabes, engraved in Sanskrit, albeit probably no earlier than the 17th or 18th century, resemble closely Islamic instruments of the 10th–11th centuries AD; they rarely reveal any later Iranian or Mughal influence; one may suppose that in the absence of an instrument-making tradition there may have been illustrations in manuscript treatises on the astrolabe.

1. This note on Indo-Iranian astrolabes is abstracted, with slight modification, from Maddison & Turner 1976, pp.117–20.
2. Mulla Badawni, *Muntakhab al-Tawārīkh*, (AH 1004/AD 1595–6), cited by Nadvi 1935, p.622.
3. Cited by Nadvi 1935, p.622.
4. See Nadvi 1935, pp.622–3, for sources; the quotation is cited from Abu'l-Fadl's *Akbar-nāmah*.
5. Gulbadan Begum, *Humāyūn-nāmah*, cited by Nadvi 1935, p.624. We have slightly altered the wording of this and of the previous quotation.
6. Nadvi 1935, pp.624–5, and Nadvi 1937, pp.537–9, for other interesting references.
7. Abu'l-Fadl, *'Ayn-i Akhbari*, cited by Nadvi 1937, p.538; see also Nadvi 1935, p.626.
8. On the name, Allah-dad, *cf.* the remarks of Storey 1958, p.157, note 3.
9. See the discussion in Nadvi 1937, pp.537–8. It should be noted that an astrolabe by Allah-dad, dated AH 975 (AD 1567–8), belongs to the reign of Humayun's son, Akbar, and was made some twelve years after the Humayun's death.
10. As note 2 to the genealogical table indicates, some 105 instruments by members of this family have been recorded.
11. One may think that the revival of astrolabe-making in Safavid Iran was connected with the serious interest in astrology in courtly circles. There are one or two instruments which may provide the suggested link.
12. See Maddison 1957, p.24, no.164; Brieux & Maddison, forthcoming, 'Muhammad Ṣālih' and 'Balhūmal'.

A family of astrolabe-makers from Lahore[1]

The number of signed, dated and undated globes and astrolabes known to us for each maker is as follows.[2] The list excludes unsigned items that can be assigned to them on stylistic grounds:

ALLAH-DAD
2, only one dated; no globes
'ISA
3; no globes
QA'IM MUHAMMAD
9, including 4 globes
MUHAMMAD MUQIM
37, one a globe
DIYA' AL-DIN MUHAMMAD
39, including 16 globes
HAMID
11, two of them globes
JAMAL AL-DIN
4; no globes.

Two astrolabes dated AH 1018 (AD 1609–10), and one undated astrolabe, are signed as made jointly by Qa'im Muhammad and Muhammad Muqim, the sons of 'Isa. They are included in the totals for both makers listed above.

The astrolabe production of this family is well represented in the Khalili Collection: Muhammad Muqim was the maker of cat.126; his son, Hamid, was the maker of the complex instrument cat.131, as well as the astrolabe cat.128; Diya' al-Din made cat.127 and 130.

1. The AD dates given in the diagram below are the range of the conversions of the earliest and last AH dates on the recorded dated instruments: many items by these makers are not dated.
2. Brieux & Maddison, forthcoming, 'Ḥāmid b. Muḥammad Muqīm', no.5 and the note under 'Allāh-dād'. See also Savage-Smith 1985, pp.34–43. Seven of the items are dated to the day and month, a degree of precision unusual on astronomical instruments.

(*Shaykh, ustādh*) Allah-dad (*asṭurlābī humāyūnī lahūrī*)
1567/8

(*mullā*) 'Isa 1601–1604/5

Qa'im Muhammad 1609/10–1637/8

Muhammad Muqim 1609/10–1659/60

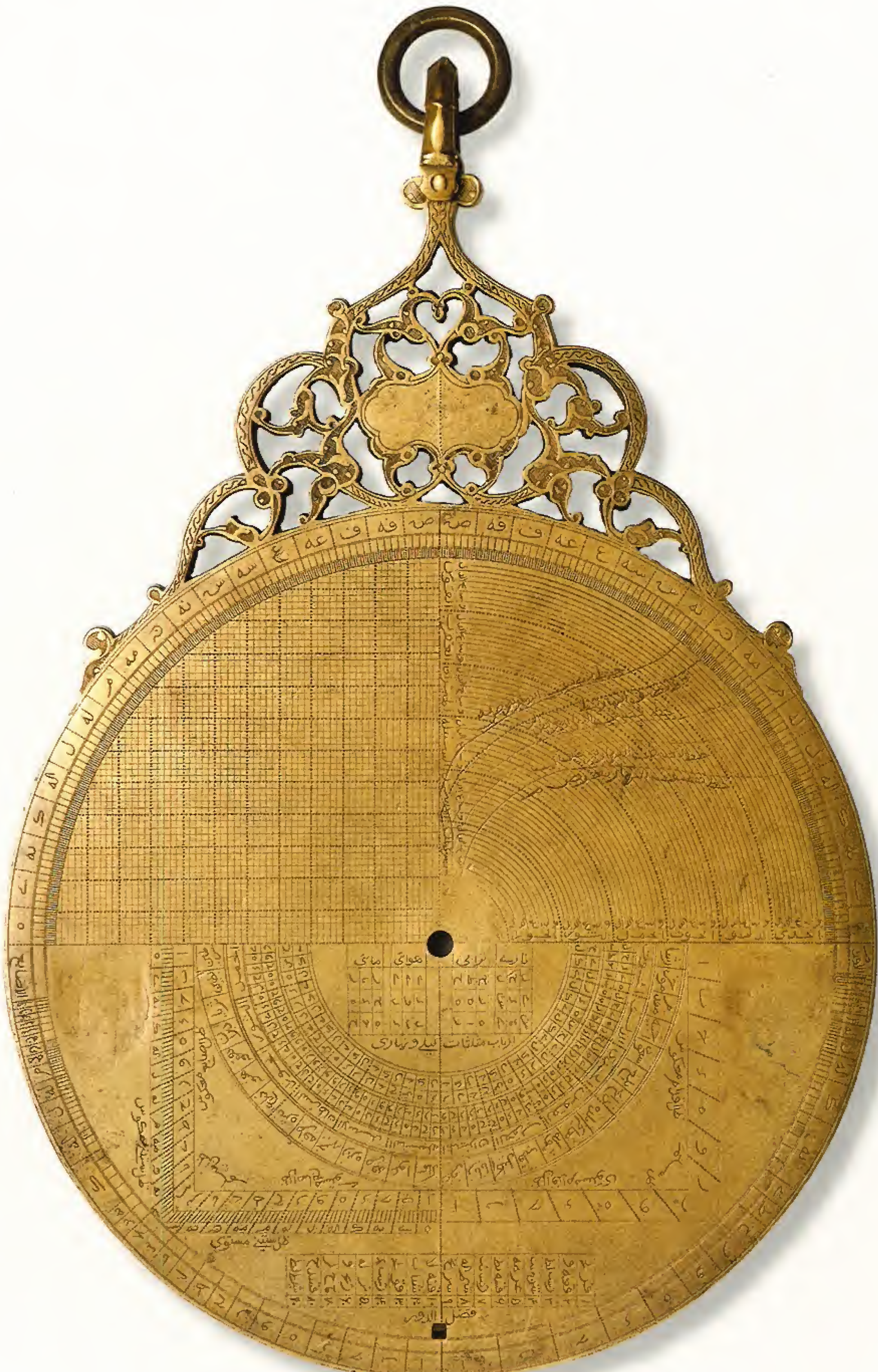
(Diya' al-Din) Muhammad 1645/6–1680/1

Hamid 1628/9–1691

Jamal al-Din 1666/7–1691/2

Figure 9 Family tree of the Lahore astrolabe-makers

126, front of mater



126, back of mater

126

Planispheric astrolabe
India, dated AH 1003 (AD 1594–5)

126, rete

126, plate

Brass, sheet and cast, cut and engraved
diameter 19.4 cm *maximum height* 27 cm (excluding the shackle and suspension ring)
maximum thickness of the mater 1.3 cm
maker Muhammad Muqim ibn 'Isa ibn Allahdad Asturlabi Humayuni Lahuri
accession no. SC136
published Christie's, London, 29 September 1988, lot no. 287

The rete indicates 38 named stars in a foliate tracery of very unusual pattern: some of this tracery is now missing at the top. The outer band of the rete, which carries a turning knob, does not represent the Tropic of Capricorn, as is normal, and the plates have a broad band beyond the circle for the Tropic of Capricorn to compensate. The ecliptic circle is divided by the horizontal bar of the rete, the portion below being divided to each degree on an inner bevelled edge, and numbered at intervals of six degrees, with the names of the zodiacal signs from Aries to Virgo cut in silhouette on the outer edge (compare cat. 122), while the portion above is similarly divided and numbered on an outer bevelled edge, with the names of the signs from Libra to Pisces engraved in relief on a hatched background. The tracery incorporates the very rare *zawraq* ('ship') design, described in early Arabic texts on the astrolabe: two intersecting arcs at the centre are oblique horizons, which would have been used with a specially drawn small 'plate' at the centre of one of the plates, now missing (but compare cat. 133); when seen together with the vertical meridian band, each arc has something of the form of a ship. There are a few construction lines on the back of the rete.

The limb of the mater is divided to each degree and numbered at intervals of five degrees. In the mater, which lacks the lug preventing the plates from rotating, there is an unusually and decoratively laid out gazetteer of the longitudes and latitudes of many places. On the back, within the upper two quadrants of 90°, are a sexagesimal sine – cosine quadrant to the left, and a quadrant of the arcs of the signs with sigmoid graphs of meridian solar altitudes for latitudes 15°, 27°, 32° and 40° to the right; below, within scales of

cotangents on the limb are a shadow square and a semicircular astrological table of the 28 lunar mansions surrounding a table of the lords of the triplicities, a division of the signs of the zodiac according to the four elements and supposed nature of the signs.[1] Below the shadow square is an unusual table showing multiples of the difference in degrees and minutes between the length of the tropical year and 365 days. The *kursī* is high and decoratively pierced in characteristic Mughal style, incorporating a blank cartouche on each side. The alidade is a replacement.

One plate (from, possibly, nine original plates) survives, for latitude 32°, hours 14′ 8″, and 27°, hours 13′ 46″. The azimuths are drawn only below the horizon, with unequal hour-lines and lines for Babylonian and Italian hours, and with a series of place-names and their geographical coordinates at the lower circumference.

The astrolabe is signed on the back, in the centre of the quadrant of the arcs of the signs, but the inscription has been badly rubbed.[2]

1. Morley 1856, p.19.
2. Brieux & Maddison, forthcoming, 'Muḥammad Muqīm b. 'Īsā 36'.

127

Mater of a planispheric astrolabe

India, dated AH 1071 (AD 1660–61)

Brass, sheet and cast, engraved
diameter 11.4 cm *height* 13.3 cm (excluding shackle and suspension ring)
maximum thickness 0.7 cm
maker Diya al-Din Muhammad ibn Qa'im Muhammad ibn 'Isa ibn Allahdad
accession no. SC111
provnance Kinloch Collection; Harriet Wynter, London; The Time Museum, Rockford, Illinois
published Sotheby's, London, 26 February 1968, lot no.12; Wynter & Turner 1975, p.19, figs 12, 13; Turner 1985, pp.84–5, figs 62–3, no.3172; Gibbs, Henderson & de Solla Price 1973, no.2607; Christie's, London, 14 April 1988, lot no.151[1]

The limb bears a scale of 360° in four quadrants of 90°, divided to each degree and numbered at intervals of five degrees. The mater is engraved as a gazetteer of the longitude and latitude of 54 places in two circular tables, and the back with two upper altitude scales of 0–90° and two lower cotangent scales, within which are a sine-quadrant (upper left), the arcs of the signs of the zodiac, with graphs of meridian solar altitude for latitudes 27° and 32° (upper right), and, in the lower quadrants, a shadow square and a semicircular astrological table. The signature and date appear in the shadow square. The triangular *kursī* is engraved in low relief, but not perforated.

1. See also Brieux and Maddison, forthcoming, 'Muḥammad b. Qā'im Muḥammad 24'.

127

128

Planispheric astrolabe

India, dated 2 Muharram 1068 (10 October 1657)

Brass, sheet and cast, cut and engraved
diameter 13.1 cm *height* 17 cm (excluding shackle and suspension ring)
maximum thickness of mater 1.1 cm
maker Hamid ibn Muhammad Muqim ibn 'Isa ibn Allahdad[1]
accession no. SC113

The rete of the astrolabe, of arabesque pattern, is for approximately 40 stars. The five plates are for latitudes 21° and 22°; 25° and 27°; 32° and 36°; a multiple plate for 0°, 72° and 90°; a plate of ecliptical coordinates, and a tablet of horizons. The azimuths are drawn below the horizon-line, with lines for

128, detail showing signature

unequal and Babylonian hours. The mater is engraved as a gazetteer for the longitudes and latitudes of 38 places. On the back there are two altitude scales of 90° each, within which are a sine-quadrant, and the arcs of the signs with graphs of solar meridian altitude for latitudes 20, 27 and 32°. Below, within scales of cotangents, an astrological table correlates the 28 lunar mansions with the signs of the zodiac, and there is a table of triplicities within a shadow square. There is a decoratively shaped alidade (without any engraved scales), a pin, a washer and a horse. The *kursī* is high, triangular and decoratively pierced.

Between the shadow square and the semi-circular band of the astrological table is the the date and the signature of the maker.

1. See Brieux and Maddison, forthcoming, s.v. 'Ḥāmid b. Muḥammad Muqīm 3'.

129

Planispheric astrolabe

India, dated AH 1031 (AD 1621–2)

Brass, sheet and cast, cut and engraved
diameter 16.9 cm *height* 218 cm (excluding shackle and suspension ring)
maximum thickness of mater 0.9 cm
accession no. SC112

The arabesque tracery of the rete is flat, perhaps because it remained to be decorated; only a few star-names are engraved on the tracery. The limb of the mater is divided to each degree and the scale is numbered at intervals of five degrees (all the *abjad* numerals are given in full so that, for example, 295° is /rṣh/). There are five plates, for latitudes 19° and 20°; 32° and 35°; 36° and 40°; 27°, and a multiple plate for 22° and 30°; a plate of ecliptical coordinates, and a tablet of horizons. The azimuths are engraved below the horizon lines, and there are lines for unequal, Babylonian, and Italian hours.

The mater is engraved as a gazetteer of the longitudes and latitudes of 69 places, arranged according to three of the seven 'climes' (the third, fourth and fifth).[1] On the back, within four quadrants of 90°, are a sine-quadrant (upper left), the arcs of the signs without any graphs of meridian solar altitudes (upper right), a shadow square within which is a table of triplicities, and an astrological table of the lunar mansions, and the terms, faces, and limits of the planets; between the semicircular bands of the table and the degree-scales are cotangent scales. The alidade is decoratively shaped and engraved with declination scales and there is a horse and pin. The *kursī* is deeply engraved, leaving an inscription in *nasta'līq* in relief against a background of foliate scrolls. The inscription begins with the invocation *Allāhu akbar* ('God is most great') and gives the Hijrah date and, on the back, the regnal year 17 of the Mughal Emperor Jahangir (*reg.* 1605–1627).

In view of several similarities between this astrolabe and cat.132 it is tempting to suggest that both are the products of the same workshop, perhaps that of one of the members of the well-known family of astrolabists and globe-makers from Lahore (see cat.126, 128 and 131).

1. On Ptolemy's κλίματα, see Aujac 1993, *passim.*

128, mater, plates and rete

128, back of mater with alidade in position

129, mater, plates and rete

130

Mater of a planispheric astrolabe

Lahore, *circa* AH 1090 (AD 1679–80)

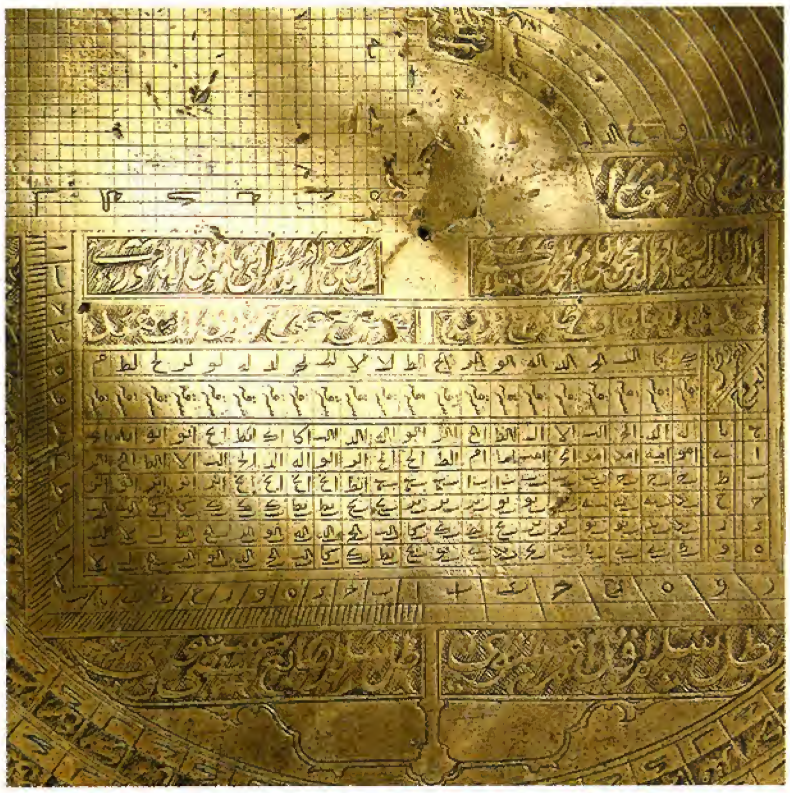
Brass, cast and beaten, engraved
diameter 28.2 cm *thickness* 1.3 cm
maker Diya' al-Din Muhammad ibn Qa'im Muhammmad ibn Mulla 'Isa ibn Shaykh Allahdad Asturlabi Humayuni Lahuri
accession no. SC1283
provenance Collection of Mrs L.Marjory Hopkins; collection of Nicolas Landau, Paris
published Sotheby's, London, 7 May 1956, lot no.114.

This is the mater of a massive astrolabe, by a member of the well-known Lahore family of astrolabists. The presence in the centre of only a small – constructional – hole, which would have to be enlarged to permit the passing through of a pin to hold plates and rete, and the absence of solar altitude curves on the upper right quadrant of the back, indicate that the mater, though finely engraved with the usual scales, was never completed. It has the high, cast triangular *kursī*, worked *à jour* in a foliate pattern, characteristic of the Lahore makers.[1]

The mater is signed, across the back, in two panels above the shadow-square: 'Work of the least of the servants [of God] Diya' al-Din Muhammad ibn Qa'im Muhammad ibn Mulla 'Isa ibn Shaykh Allahdad Asturlabi Humayuni Lahuri'; it is not dated, but the dated astrolabes and armillary spheres by Muhammad ibn Qa'im range from AH 1055 (AD 1645–6) to AH 1091 (AD 1680–81), and a total of 39 instruments by him have been recorded.[2]

The limb of the mater is engraved with a scale of degrees. Within is a gazeteer of the longitudes, latitudes and other geographical data, of 93 places. On the back are a sine–cosine quadrant (upper left), arcs of the signs of the zodiac (upper right), but without the sigmoid curve (or curves) of the meridian solar altitude characteristic of Mughal astrolabes. In the lower half are engraved a shadow-square and astrological tables.

1. *Cf.* the description of cat.128 and 131, made by Muhammad ibn Qa'im's first cousin, Hamid.
2. Brieux & Maddison, forthcoming, 'Muhammad b. Qa'im'; this astrolabe is Muhammad b. Qa'im 39.



130, detail showing signature

131

Combined planispheric astrolabe and qiblah indicator

Lahore, dated 21 Muharram 1098 (7 December 1686)

Brass, sheet and cast, cut and engraved
diameter 30 cm *height* 35 cm (excluding shackle and suspension ring) *depth* 4 cm (when closed, excluding boss)
maker Hamid ibn Muhammad Muqim ibn 'Isa ibn Allahdad Asturlabi Lahuri Humayuni[1]
accession no. SC15

This unusually large and heavy Mughal astrolabe was constructed like a circular box with a screw-on cover. The mater and cover are of roughly the same dimensions, but the mater has an external thread onto which the cover may be screwed. The rete and plates sit on an uneven lip set two centimetres above the back plate of the mater, and on a central boss, which is approximately 3.3 centimetres in diameter and is pierced, presumably to take a pin. A pair of projecting 'slots', formed from brass sheet, are soldered on to the back plate on either side of the boss. These may have retained a compass-mounting, but their purpose is obscure. The compass itself is now missing, but it was once soldered above the boss. There is no limb with a degree scale.

On the inside of the cover there is an extensive gazetteer that gives the longitude, latitude, the *inḥiraf* (the azimuth of the qiblah) and the *jiha* (the quarter of the compass in which the azimuth falls) for various places, arranged by cardinal points.

The rete indicates 39 stars with tracery of an arabesque pattern. There is an unusual ecliptic band bisected by a horizontal bar, with the lower portion (Aries to Leo) cut and engraved to a larger diameter but retaining the same counterchanged degree-scale.

The seven plates are each pierced with a circular hole, which allowed the compass to project through them and to remain visible. Five are astrolabe plates, but the other two are engraved only with lines indicating the azimuth of the qiblah from various places; miniature versions of these plates occur at the centre of the other five. Four of the astrolabe-plates are engraved for latitudes 17° and 18°; 20° and 21°; 25° and 28°; 27° and 29°; while the fifth is engraved for latitude 32° on one side and with a tablet of horizons on the other. The plates are engraved below the horizon line with azimuths and with lines for Babylonian hours, and a scale of degrees (four times 90°, marked at intervals of six degrees) has been inscribed around the edge of each plate, as the addition of the projecting flange means the mater lacks the usual scale on the limb.

The alidade, horse and pin of the astrolabe are missing, and it is not clear where they would have been placed.

The high *kursī* is not perforated, as is usual on Mughal astrolabes, but the back bears crudely engraved decoration and the front an erased inscription.

On the back of the mater there is a sine–cosine quadrant (upper left) and a quadrant of the arcs of the signs of the zodiac, with sigmoid graphs of meridian altitudes of the Sun for latitudes 20°, 21°, 27° and 32° (upper right), both framed by scales of 90°. In the space at the centre of the second quadrant there is an inscription giving the name of an owner, Qadirdad Khan Mohandis, and the date AH 1186 (AD 1772–3). The lower two quadrants are framed by a scale of cotangents and are filled with an astrological table of the 28 lunar mansions and of the triplicities, and the terms, faces and limits of the planets. The maker's name and the date of manufacture appear in a semicircular band that runs along the inside of the scale of cotangents. Ten instruments by this maker, eight astrolabes and one celestial globe, have been recorded, ranging in date from AH 1038 (AD 1628–9) to AH 1102 (AD 1691), seven of them precisely dated to the day and month of the year, unusual on astronomical instruments.

1. See Brieux & Maddison, forthcoming, 'Hāmid b. Muhammad Muqim'.

131, mater and rete

132

Planispheric astrolabe
Probably India, 17th century

Brass, sheet and cast, cut and engraved; the *kursī* is set with flush silver studs
diameter 33.2 cm *height* 42.3 cm (excluding shackle)
maximum thickness of mater 1.25 cm
accession no. SCI10

This large but unfinished astrolabe appears to be late Mughal. The tracery of the rete is flat as if awaiting engraved decoration but the engraved script is very clear and crisp. The rete is of foliate pattern, with 28 named star-pointers. The five plates are for latitudes 32° and 35°; 36° and 40°; 27° and a multiple plate for 30° and 25°; and a plate of ecliptic coordinates and a tablet of horizons, mostly with azimuths below the horizon, and with hour-lines for unequal, Babylonian, and Italian hours.

The mater is engraved as a gazetteer of the longitude and latitude of 69 places, arranged in three bands according to the seven 'climes' (the third, fourth and fifth). On the back are scales of degrees in four quadrants of 90°, within which are a sine-quadrant, a quadrant of the arcs of the signs,[1] a shadow square within which is a table of triplicities, and an astrological table of the lunar mansions and the terms, faces, and limits of the planets; between the semi-circular bands of this table and the lower degree-quadrants are scales of cotangents, not usually found in this position. There is a rule bearing declination scales, but no sight vanes, so it would not be usable as an alidade. There is no original pin or horse. The *kursī* is high and triangular, of characteristic Mughal shape, but instead of being decorated *à jour* it has been deeply and finely engraved with a foliate scroll (compare cat.129).

1. This is unfinished and lacks any graphs of solar meridian altitude.

133

Planispheric astrolabe
India, 17th century

Brass, sheet and cast, cut and engraved; the rete is inlaid with silver
diameter 52.5 cm *height* 60 cm (excluding shackle and suspension ring) *thickness of mater* 1.6 cm
accession no. SCI53

This remarkably fine, large astrolabe illustrates the symbiosis of Hindu and Muslim astrological and astronomical traditions.[1] The inscriptions are in both Arabic and Sanskrit. In general, in its complexity this astrolabe is typical of the Lahore school,[2] but the exuberant foliate tracery of the rete is in contrast to most Lahore work, which is somewhat severe. The design of the tracery is that of a branching stem, each branch bearing several pointed leaves, where the points and other protuberances are star-pointers. The Arabic inscriptions on these pointers are inlaid with silver. The stem culminates in a 'flower', consisting of an empty circle, with petals issuing from the circumference, within and at the top of the ecliptic circle. Unusually the tracery includes a partial meridional band within the ecliptic circle, crossed by two curved bands representing 'oblique' horizons for two latitudes, one for latitude 29°, the other for latitude 32°. The portion of the meridional band above each horizon in association with the horizon resembles the outline of a ship with a single mast, hence the name *zawraq* given to this type of rete.[3] The degree scale on the limb is numbered at intervals of three degrees, as befits an instrument of this size.

The *kursī* is decoratively engraved in relief on both sides: on the front there is a floral design, on the back, four birds among flowers. The design shows a hawk pecking at the entrails of a duck; the two other birds, one of which is crested, are peacocks.

There are six plates, the usual complexity of the projections on Mughal instruments made more apparent by the duplication of the Arabic inscriptions in Sanskrit. The plates are for 0° and 90°; 0°35′ and 3°; 27° and 29°; 37° and 39°; and 42° and 45°; also a plate with a quadripartite tablet of horizons (of the common eastern Islamic pattern), and a tablet of coordinates of the ecliptic (66°).[4]

On the plate for 3°, the length of the longest day is given not in hours and minutes but as 40 *ghaṭī* (here spelt *ghāṭī*). On the other side, where the latitude appears to be given as 35′, the length of the day is also given in *ghaṭī* (here spelt *ghāṭā*) as 32 [*gh.*] 0 [*vip.*]. A *ghaṭī* is an Indian division of the day, corresponding to 24 of our minutes.[5]

The reverse side of the first plate mentioned above, that for 0° and 90°, is particularly complex. It includes, in the centre, a small projection, with the ecliptic circle and some stars marked, for use with the *zawraq* part of the rete. The two arcs of the *zawraq* must terminate at each end of the circle of Capricorn. Given that the *zawraq* is small, this requires an appropriately small plate to be engraved in the centre of the large plate.

The mater is engraved as a gazetteer showing the longitude, latitude and *inḥirāf* of a great number of places, which are arranged by region, with India at the centre. Some of the plates and the gazetteer use the Greek-derived symbol for zero, ƺ.[6] On the back of the mater there are a sine–cosine quadrant (upper left), a quadrant of the arcs of the signs of the zodiac (upper right), with three sigmoid graphs for the meridian altitude of the Sun, throughout the year, for the latitudes 27°, 29° and 32°. Below, the two lower quadrants are engraved with a shadow square, within which there is an astrological table of triplicities. These are framed by semi-circular scales of the signs of the zodiac, the 28 lunar mansions, and terms and faces of the planets.[7]

The alidade, horse and pin are missing.

133, detail of rete showing *zawraq*

118, detail of folio 178b showing *zawraq*

1. *Cf.* al-Biruni–Sachau and al-Biruni; Asadullah Mirza–Elwell-Sutton 1977.
2. Compare cat.126, 128, 130–32, and see above, p.219, and Turner 1985, p.83, for the complexity of Lahore astrolabes.
3. Gunther 1932, I, pp.218–20 and fig.113, and pl.XLVIII and XLIX, no.90; Turner 1985, pp.78, 79, fig.59; on the *zawraq*, see Sédillot 1844, pp.182, 183, and pl.27, fig.89, for the account by Abu 'Ali al-Hasan ibn 'Ali 'Umar al-Marrakushi of unusual astrolabe retes, which depends on al-Biruni's 11th-century treatise on making astrolabes, and on al-Sijzi (*circa* AD 945–AD 1020). See above, p.192, for a copy of al-Marrakushi's work in the Khalili Collection.
4. On plates for 0° and 90°, and the tablet of coordinates of the ecliptic, see Michel 1947, pp.60, 61.
5. *Cf.* cat.144. A *ghaṭī* is subdivided into 60 *pala*, which in turn each contain 60 *vipala*, which comprise 6 *prāna*. 60 *ghaṭī* correspond to our twenty-four hours. The *ghaṭī* are counted from sunrise. Another name for them is *ghaṭikā*, which is also the name for a simple form of clepsidra, consisting of a bowl with a hole in the bottom. The bowl is floated on the water and as it sinks, time is indicated by graduations marked on it. See Frédéric 1987, p.421; Maddison 1957, p.46, no.191.
6. *Cf.* cat.144.
7. Morley 1856, pp.29–31.

133, detail

134

Celestial globe

Mughal India, dated AH 1074
(AD 1663–4)

Brass
horizon ring diameter 25.4 cm inner, 27.3 cm outer
height of stand 20.8 cm
weight 4.95 kg (globe only)
maker Muhammad Salih Tatawi, with later additions by Nandaraya
published Savage-Smith 1985, pp.231–2, no.29 and pp.44–45, fig.18; Riyadh 1985, p.87, no.69
accession no. SCI45

This is a fine, precise globe made by a well-known 17th-century instrument maker who worked in north-western India. Beneath the constellation of the Southern Fish (*Piscis Austrinus*) a short Arabic inscription states it to be the work of Muhammad Salih Tatawi in AH 1074 (AD 1663–4), who is known to have made a similar globe four years earlier, and at least three astrolabes.[1]

Muhammad Salih Tatawi's celestial globe of AH 1071 (AD 1659–60) was produced for a patron named Shaykh 'Abd al-Khaliq, who is otherwise unidentified.[2] Both in design and in the use of extensive star captions, this globe is close to that in the Khalili Collection, though it lacks the additional *devanāgarī* inscriptions. On it, however, the maker wrote his name slightly differently – that is, *Tatah-wī* instead of *Tatawī* as it reads on cat.134. There has been some question as to where in India the maker might have worked and whether he came from the town of Tatta in the Sind, the delta of the Indus.[3] The town of Tatta should more accurately be transliterated as Ṭhaṭṭhā, with a different form of 't' than that used on the globe and with the letter *hā'* after the first 't'.

The fact that the sphere is seamless, cast by the lost-wax method, suggests that the maker worked in north-west or north-central India, where the four generations of the Lahore workshop perfected the technique (see above, p.219). It would be reasonable to assume that a craftsman as skilled as al-Tatawi would follow the court for patronage, and, since Delhi had been the seat of the Mughal court since 1648, al-Tatawi may well have had his workshop there.

A distinctive feature of this globe is the captioning in both Arabic and Sanskrit, the latter being in *nāgarī* script.[4] The *nāgarī* captions, giving the names of constellations and lunar mansions, and numbering along the ecliptic and equator were added by an engraver, perhaps with the assistance of an astronomer, named Nandaraya, at least a century after al-Tatawi completed the globe, probably in 1767 though possibly as late as 1802.[5] The deep engraving of the Sanskrit labels, and the somewhat wavy lines, drawn parallel to the ecliptic and equator, that frame the *devanāgarī* numbering, contrast with the original engraving by Tatawi; and the edges of the engraving in *devanāgarī* do not show as much wear as the engraving in Arabic. These features corroborate the statement that these are later additions to the globe.

Two other celestial globes, both dated AH 1073 (AD 1662–3), have Arabic inscriptions attributing them to Muhammad Salih Tatawi.[6] They are, however, clearly part of a group made recently, several of which have false attributions (see Part Two, Appendix 1).

The present stand and horizon ring of cat.134 are not contemporary with the globe and were apparently made when the Sanskrit inscriptions were added. As the stands of two of the recent fake globes are strikingly similar to that of cat.134,[7] it was presumably known to the workshop which produced the modern group.

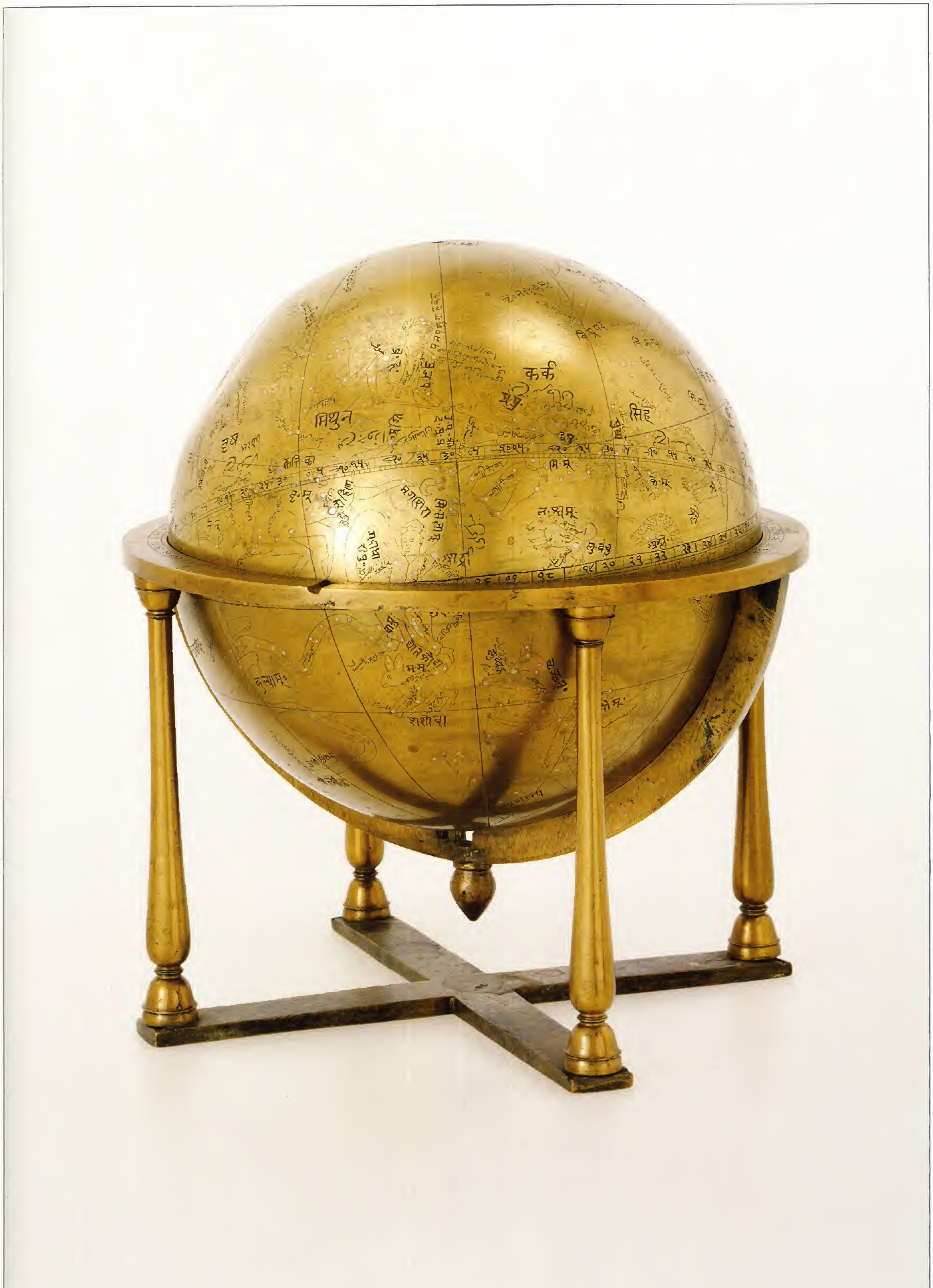
The sphere is engraved with 48 delicately incised constellation outlines and indicates about 1018 stars by inlaid silver points of graduated sizes to show magnitude. In addition to the six ecliptic latitude-measuring circles, there are engraved on it the two tropic circles, the ecliptic, and celestial equator. The latter two are carefully graduated by single degrees with every fifth labelled in *abjad* letter-numerals; every sixth degree has been later labelled in *devanāgarī* numerals. The numbering along the equator runs continuously from the vernal equinox, while that along the ecliptic repeats every 30°. The ecliptic poles, tropic circles, ecliptic latitude-measuring circles, the greatest distance of the ecliptic from the equator, the constellations, zodiacal houses, and the major stars are all labelled in Arabic, with some of the star labels being more detailed than usual.

A large figure-eight plug left from the casting process is visible. There are approximately 17 chaplets (tablet-shaped, round or irregular) which appear to be of copper. Lathe-turning marks are apparent, though these may be due to later abrasion. The sphere has been aggressively cleaned and the surface recently lacquered.

134, detail of *devanāgarī* inscription

The meridian ring is an obvious modern replacement. The quadruped stand with spindle-shaped legs is on a base formed of two cross bars. Attached to the underside of the horizon ring is a semicircular bar, with a finial at the bottom, which supports the meridian ring. The graduations on the horizon ring are identical in size to those on the sphere, though on the ring every sixth degree is indicated by a deep line and labelled in *devanāgarī*, while on the sphere it is every fifth degree that was highlighted by a dotted line and labelled in Arabic at the time of construction.[8]

1. One dated AH 1076 (AD 1665) was in the East India Company Museum; see Morley 1856, pp. 37–9; and Gibbs, Henderson & de Solla Price 1973, no. 23. Another astrolabe dated AH 1077 (AD 1666–7) is in the Museum of the History of Science, Oxford University (Gibbs, Henderson & de Solla Price 1973, no.2502), and a third is in a private collection. For further details on these three items, see Brieux & Maddison, forthcoming.
2. Red Fort Archaeological Museum at Delhi, inv. no. 40–415. See Savage-Smith 1985, pp.229–30, no.25; Dhama 1933, pp.143–4 and pl.LVIII for an illustration; and Sarma, Ansari & Kulkarni 1993, p.57.
3. See Savage-Smith 1985, p.44; Sarma, Ansari & Kulkarni 1993, p.58.
4. For some of the Hindu astronomers active in the 18th century, see Sarma 1992, pp.240–1; Ohashi 1986, pp.173–4.
5. Near the Arabic signatory inscription, beneath the constellation Centaurus, there is a deeply incised Sanskrit two-line inscription in *devanāgarī* script. It reads: 'This globe was embellished by Nandaraya on the fifth day of the bright half of the month *suci* in the year *Siddha-nāga-indu*.' The year referred to is most likely 1767, assuming the *Saṃvat* era was intended. If the *śaka* era was intended, then the year of the Sanskrit engraving would be 1802. The Sanskrit was read and interpreted by Dr Jonathan Katz, formerly of the Indian Institute Library, Oxford University.
6. See Sarma, Ansari & Kulkarni 1993, pp.59–60, globe 'A'.
7. The globe described in Savage-Smith 1985, pp.240–41, no. 43, and the globe attributed to Tatawi and illustrated in Sarma, Ansari & Kulkarni 1993, p.61.
8. Savage-Smith 1985, p.232 states that the horizon ring and stand appear to be contemporary with the globe. Further consideration and comparison with globes then unknown now suggest that this assumption was incorrect.


कर्क
मिथुन
सिंह


کرسی

135
Mater of a planispheric astrolabe
India, *circa* 1800

Marble, engraved and coloured
diameter 20.6 cm *height* 29.4 cm
thickness 2.6 cm
accession no. SC142

This object is either the mater of an unusual astrolabe of marble, or the template for a mater.[1] The limb is divided to each degree and numbered by sixes. Inside the mater there is a gazetteer of various places in India and the Middle East. On the back on the limb are four sexagesimally divided scales of degrees, numbered in large *abjad* numerals, and a sine quadrant with badly drawn lines and divisions; a quadrant of the arcs of the signs of the zodiac (Indian style) with a graph of the Sun's meridian altitude throughout the year for latitude 30°, and *aṣr* for the same latitude; a shadow-square; and a semi-circular astrological table of the signs of the zodiac and the 28 lunar mansions. The high, triangular *kursī* recalls the astrolabes of Mughal India, but is not worked *à jour*.

This astrolabe was probably intended for teaching or as a model for the construction of conventional astrolabes, because several of the essential lines and parts are designated by their descriptive terms. For example, the word *kursī* is engraved across the front of the *kursī*, and the phrase *khaṭṭ 'urwa 'ilāqa* ('line of the loop of the suspension cord') alongside a meridian line passing through the centre of the hole for the *'ilāqa*.

1. There is another stone astrolabe in the History of Astronomy Collection of the Adler Planetarium, Chicago, inv. no. W273. It is North Indian, a single plate of dark green stone inscribed in *devanāgari* script with the date 1766 (Vikrama Samvat = AD 1709) and words which translate as 'Amer Observatory', the precursor of Jaipur Observatory; like the astrolabe described here, it might be either a didactic instrument or a template. See Pingree, forthcoming, Appendix 1, entry AA.

136
Planispheric astrolabe
India, *circa* 1800

Brass, sheet and cast, cut and engraved
diameter 18.9 cm *height* 22 cm (excluding shackle and suspension ring) *thickness of mater* 1.1 cm
accession no. SC129

This instrument has a thick rete, with 26 star-pointers, of which only some are named. There are no loose plates. The mater is somewhat massive with a wide limb on which the degree divisions are numbered twice, once in *abjad* (at intervals of five degrees in four quadrants of 90°) and once in numerals (at intervals of ten degrees, in a single clockwise run of 360°). The type of numerals used indicates that this astrolabe is Indian work. The inside of the mater is engraved as a plate, but the latitude is not marked.

Of the quadrants on the back, one is a sine quadrant, although the sexagesimal dividing lines are not parallel and horizontal, with the five-degree radial divisions also drawn (upper left); another is engraved with arcs of the signs that are not in stereographic projection, as on Iranian instruments, but equally spaced as on Indian ones (upper right); the limb numeration is in *abjad* and numerals, as on the front. In the lower two quadrants there is a double-scaled shadow square and, around the limb, a long Persian inscription engraved in *naskh* which gives instructions identical in text and hand to those on cat.137.

The front of the *kursī* is decoratively engraved in relief, the back was left blank. The alidade is cruciform, with sight-vanes on a straight-bar, and radial pointers at the end of a curved bar; the horse is missing.

This astrolabe may have been used for teaching and was clearly produced by the same maker as cat.137.

137
Planispheric astrolabe
India, *circa* 1800

Brass, sheet and cast, cut and engraved
diameter 11.6 cm *height* 13.4 cm (excluding shackle and suspension ring) *thickness of mater* 0.6 cm
accession no. SC1153

This small but massive astrolabe is very similar to cat.136, even to the extent that the instructions in Persian engraved along the lower section of the rim of the back of the mater are the same, and the two instruments are clearly by the same maker. It may have been intended for didactic use: the *abjad* notation is repeated in numerals as if the user would be unfamiliar with *abjad*; and various lines are named. Stylistically, the instrument is hard to place, but the type of numerals employed indicates an Indian origin, as in the case of cat.136.

The front of the *kursī* is engraved with a foliate pattern, the back is blank. The left-hand upper quadrant of the back is engraved with a badly executed sine diagram, with radial lines at intervals of five degrees. The right-hand upper quadrant has 20 numbered concentric, equally spaced arcs. The two lower quadrants contain a shadow square.

136

137

138

Celestial globe

India, dated AH 1257 (AD 1841–2)

High-zinc brass
diameter 13.36 cm
ring diameter 14.4 outer, 13.8 cm inner
weight 0.55 kg sphere, 0.10 kg ring
maker Muhammad Na'im al-Din Muradabadi
patron Muhammad Amjad 'Ali Shah
accession no. SC14

An informative inscription, placed in the southern hemisphere, records: 'This globe was copied from the globe of [? made by] Akbar Shah Muhandis Jahanabadi, which [that is, the copy] in the year AH 1260 (AD 1844) was presented as an offering to the honorable, the emperor of the age, the father of victory, the reformer of the faith, the exalted as the Pleiades, Muhammad Amjad 'Ali Shah sovereign. The poor, the base Muhammad Na'im al-Din Muradabadi, may God forgive him, completed this copy in the year 1257 [AD 1841–2] by the grace of God on High, in a better and more complete fashion than the original[1] had been made, praise and thanks be to God.'

Whether Akbar Shah Muhandis Jahanabadi was the maker or merely the owner of the globe that served as the model is not clear from the wording of the inscription, but given the fact that *muhandis* means engineer or technician, it is likely that he was the maker.[2] His *nisbah*, Jahanabadi, would suggest a familial association with a town of that name, and there are several small towns named Jahanabad in India, one south of Lucknow and Kanpur, and another south-east of Rampur. No instrument-maker of such a name is otherwise known through written sources or extant artefacts. Consequently, where and when the earlier globe was constructed is unknown.

The copy made in AH 1257 (AD 1841–2) was presented three years later to Muhammad Amjad 'Ali Shah, who became Nawab of Oudh in AD 1842. Nothing further is known of the maker of the copy, who boasts of having improved upon his exemplar.

Since the globe by Muradabadi, made during the reign of the last Mughal emperor, is stated to be a copy, with some improvements, we can assume that the instrument of Akbar Shah Muhandis Jahanabadi was similar in design but not necessarily in the method of construction. The star positions on Muradabadi's globe correspond roughly to those on Indian 17th-century globes, such as those from the Lahore workshop, which was active from 1567 to 1692 (see above, p.219). This might imply an early 17th-century date for the Jahanabadi globe. On the other hand, the stars are not placed with consistent precision, so it may be unwise to extrapolate from such details.

138, detail showing the constellation of Argo Navis

Muradabadi's globe has 48 constellation figures of typically late Mughal design. The faces on all the human figures have been left blank. Approximately 1018 stars are indicated by inlaid silver points, each star being numbered within a constellation in standard numerals. Carefully incised circles mark the ecliptic, the equator, the tropics, the polar circles and two unnamed smaller circles around the celestial poles. The ecliptic and equator are carefully graduated in single degrees with every sixth labelled in *abjad* letter-numerals, the ecliptic repeating every 30° and the equator numbered continuously from the vernal equinox. The tropics, the polar circles, the south ecliptic pole and the equinoxes are labelled in Arabic. Although the circles and graduations are precisely laid out and the stars carefully numbered, the positioning of the stars themselves is not particularly good.

The sphere is constructed of two hemispheres joined along the equator by an internally soldered strip. The incised lines have two different compounds in them, one black and one red, the latter appearing to be the earlier material. The meridian ring is made of a brass similar in composition to that of the sphere. It is attached to the celestial poles with a pin at the south pole and with a wing-screw at the north pole. The ring is unusually wide (1 centimetre) and is graduated by single degrees with every sixth labelled in *abjad* letter-numerals, beginning at the points of attachment. The horizon ring is missing.

1. Reading *aṣl* instead of *ṣill*.
2. The grammatical structure of the inscription does not permit the interpretation that the globe was made for Akbar Shah by a maker named Muhandis Jahanabadi, in addition to which it would be unlikely that either Mughal ruler of that title would have been referred to without numerous honorific epithets. See Savage-Smith 1990, p.27.

139

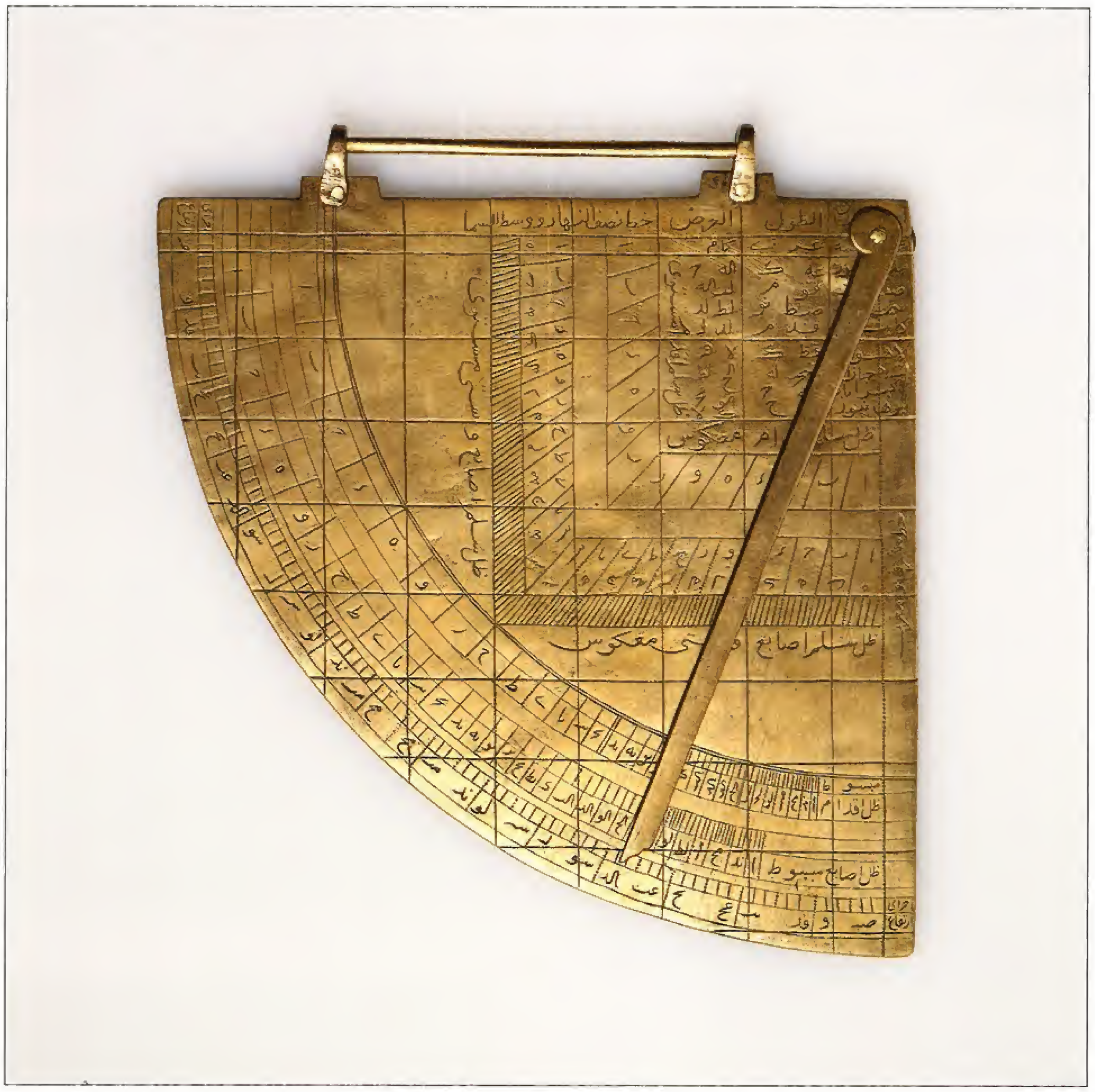
Sine–cosine quadrant

Probably India, *circa* 1800

Brass sheet, engraved
outside radii 20.5 cm and 20.6 cm
accession no. SC131

Along one radius, the quadrant is equipped with a tubular sight, its supports riveted to the quadrant plate. On one side, the quadrant is engraved as a sexagesimal sine–cosine quadrant, with lines for the obliquity of the ecliptic and versed sine, and the relative positions of ten named stars. Pivoted at the apex is a rule, engraved with linear sexagesimal (declination) scales, which moves over the 90° scale at the limb.

On the other side a 90° scale is marked at the limb. Within it there are two cotangent scales corresponding to the 'finger' and 'feet' scales of a shadow square. There is a shadow square above these scales, and within it a table of the longitudes and latitudes of places in India, Afghanistan and Iran. A plain rule, moving over the degree-scale, is pivoted at the apex.



139, back

139, front

Two globes by Balhumal

In the 19th century the instrument-making tradition established in Lahore in the 16th and 17th centuries was perpetuated in the work of the Hindu metalworker Lalah Balhumal Lahuri. As his name implies, he originated from Lahore, and from inscriptions on his instruments it is evident that his workshop was located there. All the globes produced by him employed the *cire perdue* or lost-wax technique of casting seamless spheres which is associated with the earlier Lahore products.

Balhumal is known by two signed celestial globes, with the 48 classical constellations, about 1018 inlaid stars, and Arabic inscriptions. Both globes were made in AH 1258 (AD 1842), one for the Sikh patron Nihal Singh Sahib Bahadur Ahluwaliyah, who ruled Kapurthalah, only a few miles south-east of Lahore, from 1837 to 1852.[1] Balhumal also produced several astrolabes, one of them for the same patron after he had been made a Rajah by the British government.[2] Another astrolabe bears a Persian inscription stating that it was designed in 1849 for Sir Henry Elliott, K.C.B., Chief Secretary to his Lordship the Governor-General in Kapurthalah.[3]

The Balhumal workshop produced excellent and precise products that are easily identifiable by their workmanship and several distinctive features in the iconography, star positions, design of the stand and rings, and the execution of the graduations. Balhumal also added to all his globes six meridian circles at right-angles to the equator, along with the ecliptic latitude-measuring circles. Meridian circles are unusual in Islamic globe design, but Balhumal made them highly idiosyncratic by shifting them six degrees westward so that no meridian represents the equinoctial colure.

Among the objects that can be attributed to his workshop are a Sanskrit celestial globe with captions entirely in *devanāgari* characters,[4] and two globes in the Khalili Collection, cat.140 and 141. The former was made for, or at least later owned by, a Hindu astronomer or astrologer (*jotishī*) named Daharamchand. It has the 48 classical constellations with captions in Arabic. The second globe is unusual in that all the inscriptions are in English, implying that Balhumal made this instrument for an English-speaking patron, as he had made the astrolabe for Sir Henry Elliott. What Balhumal's source was for his English captions is unknown, but some names are distinctive, such as the use of 'Painter's Horse' for Pegasus. Although the captions are in English, the instrument is completely within the tradition of Islamic celestial globemaking and constitutes a fine example of the metal working and instrument-making practices in north-west India in the 19th century. Although the engraving on cat.140 contains an error, it is of better quality than that on cat.141, made for the English-speaking patron. It is possible that cat.140 was intended for an exceptionally highly-placed client. However, the error of engraving the globe with one end as the north pole and then inadvertently inverting the sphere and beginning anew at the other pole, may so have devalued the piece that it was left unfinished, unsigned and undated, only to come later into the possession of the Hindu astronomer/astrologer Daharamchand.

1. The present location of one is unknown, while the other is in Karachi, National Museum, inv.no. N.M.1957.1049; see Savage-Smith 1985, pp.235–6, no. 33, pp.275–6, no.127, and p.53, fig. 24.
2. The present location of this astrolabe, made in 1851, is unknown; see Savage-Smith 1985, p.305, n.180; and Brieux & Maddison, forthcoming.
3. London, Science Museum, inv.no.1982–777; see Gunther 1932, I, pp.171–3, Brieux & Maddison, forthcoming; and Anderson 1982, p.35, no.129a.
4. New York, Columbia University, David Eugene Smith Collection, inv. no. 27–244; see Savage-Smith 1985 p.245, no.54, and p.54, fig.25; and Savage-Smith 1992a, p.49. For another globe attributable to Balhumal, now in Rockford, Illinois, Time Museum, inv.no.1175, see Savage-Smith 1985, pp.263–4, no.90, and p.55, fig.26.

140, detail showing the constellations of Hercules and Serpentarius

141, detail showing the constellation of Pegasus ('Painter's Horse')

140

Celestial globe

India, first half of the 19th century

Leaded tin high-zinc brass (globe); high-zinc brass (stand)
diameter 37 cm
diameter of horizon ring 22 cm inner, 26.5 cm outer
height of stand 16.8 cm
weight 2.95 kg with meridian ring; stand and zenith ring 3.7 kg
accession no. SC1285

This undated and unsigned globe with a full set of constellation figures has the distinctive features characteristic of products from the workshop of Lalah Balhumal Lahuri, which flourished in the first half of the 19th century. Although possibly unfinished due to a curious error on it, it is nonetheless a carefully and precisely engraved instrument.

In addition to the six great circles that are ecliptic latitude-measuring circles, there are six great circles at right angles to the equator, but these six meridians are shifted, as is characteristic of Balhumal's work, six degrees westward so that no meridian represents the equinoctial colure.

The globe bears the classic Ptolemaic constellations, rendered in precisely the Mughal design employed on all Balhumal's work with constellation outlines. Approximately 1018 stars are indicated by inlaid silver points, but none are labelled although the constellations are. The constellations are also numbered, as are the stars within them. Polar circles, the two tropic circles and lesser circles at 12° and 20° either side of the equator are inscribed.

The ecliptic and equator are carefully graduated by single degrees with every sixth indicated by a longer line. Along the equator, beginning at the meridian circle nearest the vernal equinox, each 6° space is numbered in sequence, 1 through 60, using *abjad* letter-numerals. The ecliptic has every sixth degree labelled in *abjad* letter-numerals, repeating every 30°.
An unusual feature of this globe is the placement of two numerals instead of one at every 6° interval along the ecliptic, one sequence of numerals reading from the north and the other sequence reading from the south. This labelling reflects the fact that work was apparently begun on the sphere with one pole designated as north. For some reason the sphere was then inverted and the other pole taken as north. As a result there are two Small Bears (Ursa Minor) on it, one at the south celestial pole and one at the north celestial pole, and the labels on both the north and south celestial poles have been changed. Moreover, the names of the zodiacal houses were originally all inlaid in silver and oriented so as to be read from the south pole. They were then rubbed down and reengraved so as to be read from the north. Despite these errors and re-engravings, the workmanship on the globe is of high quality and the precision of the instrument is excellent for this period of instrument making.

The seamless sphere has a large round sprue or coreplug, 4.4 centimetres in diameter, at the tail of Cygnus and a similar one in Argo Navis on the opposite side of the sphere. One copper rectangular plug, measuring 1.7 × 1 centimetres, at the waist of Hercules is visible along with a number of circular chaplets, also of copper, varying in diameter from 0.4 to 0.7 centimetres.

The rings and stand are contemporary with the globe and typical of the Balhumal workshop. The meridian ring is graduated on both faces by single degrees with every sixth indicated by a long line. On the top face of the meridian ring the intervals are numbered in both *abjad* and standard numerals. One half of the ring is recessed slightly from the surface of the sphere, and a sliding sleeve can be moved along the recessed semicircle; the sleeve is the length of 6° with 2° intervals indicated on its sides and a threaded hole at the centre top. The meridian ring is attached by screws to the celestial poles, with cloth pads between to prevent abrasion.

The detachable zenith ring sits in rectangular slots in the horizon ring and is held firm by two wing-screws. At the apex of the zenith ring is a triangular projection reminiscent of the suspensory device, or *kursī*, on an astrolabe. On one face of the zenith ring there is the inscription stating that the owner is a Hindu astronomer or astrologer (*jotishi*) named Daharamchand. Nothing is known about this person, who apparently flourished in the mid-19th century.[1]

The horizon ring is also graduated in a pattern similar to the meridian ring and sphere, with both *abjad* and standard numerals labelling the 90° quadrants, starting at the slots for the zenith ring. Three s-curve legs, with a doubled tulip design at the centre and resting on rounded feet, are attached by wing-screws to the underside of the horizon ring. Also attached by screws to the underside of the horizon ring is a semicircular arc on which rests the nadir of the meridian ring.

1. The last part of the name, *-amchand*, implies a name from West India or Gujarat; see Philips 1951, p.51.

141

Celestial globe

India, first half of the 19th century

High-zinc brass (both globe and stand)
diameter 36 cm
height of stand 15.8 cm
weight 3.4kg (with meridian ring)
accession no. SC144
published Savage-Smith 1990, pl.3; Christies, South Kensington, 29 September 1988, lot no.15

This unsigned, undated, and possibly unfinished, celestial globe has all the hallmarks of the workshop of Lalah Balhumal Lahuri, although the labels on it are all in English.

The iconography of the 48 classical constellations and the positions of the inlaid silver points representing stars are identical to those on cat.140 and to all other products of this workshop. The placement of the tropics and the two inner circles, the polar circles, and the 'meridians', and also the graduation of the ecliptic and equator, all conform to the style of the Balhumal workshop.

What distinguishes this particular product is the English labelling. Both the ecliptic and the equator are numbered in Western numerals to be read from the south rather than north in order to maintain the proper west-to-east sequence around the globe. In all of the northern constellations and in the first seven of the zodiacal constellations the stars are assigned European numerals rather than Arabic ones. The celestial poles are labelled in English ('North Pole, South Pole') and the zodiacal houses are labelled in English along the ecliptic, with Aries to Virgo reading from the north and Libra to Pisces reading from the south. However, the zodiacal constellations themselves are not labelled, though most of the other constellations are given English names. Of the 18 out of 21 northern constellations that are labelled, some are given rather unusual names: Painter's Horse for Pegasus, Pegasus for Equus, Cerberus for Cygnus. Only 10 of the 15 southern constellations bear titles, and some of these are confused: Orion for Cetus; Lepus for Orion, and Hydrus for Eridanus. The constellations are numbered with a small engraved numeral in Arabic script beginning with 1 in Ursa Minor to 47 in Corona Australis. The forty-eighth constellation, Piscis Austrinus, is unnumbered. A few stars, such as those near Aquarius, are numbered with Arabic rather than European numerals.

At the eighth zodiacal constellation, Scorpio, the numbering of the stars with European numerals ceases. The outline of Scorpio seems incomplete as do some of the other constellation outlines. A slight error, a gouge made near Capricorn and Aquarius, may account for it being unfinished. It seems also that more than one artisan may have worked on the engraving of the constellations. Nevertheless, the globe is carefully executed and a good example of the Balhumal workshop.

X-rays confirm that the globe is a seamless cast sphere. One large sprue or core plug, 4.2 centimetres in diameter, is obvious in Leo, as are a number of smaller plugs which probably replaced the original chaplets, which were drilled out and replaced with the same alloy as the sphere. The engraving is filled with a white compound. Most of the great circles have been traced lightly and then retraced deeply.

The rings and stand are nearly identical to those on cat.140. The sliding sleeve on the meridian ring is 10° in length rather than 6°, and attached to the slide is a rotatable 90° arc also graduated by single degrees with every sixth labelled in European numerals from the lower end up to the point of attachment to the slide. The numbering of the meridian ring is along its sides, while its top face is blank except for a groove down its centre. Both faces of the zenith ring have a floral and leaf design interspersed with patterns of five dots. Scrolling stems are engraved on the top edge. An oval ring pivots at right angles to the top of the *kursī*. The zenith ring is currently attached to the horizon ring with modern screws that cannot be easily removed. The horizon ring is labelled in European numerals in a pattern identical to cat.140, and there are engraved scrolling vines interspersed with the five-dot pattern seen on the zenith ring.

142

Universal equinoctial sundial

Probably India, *circa* 1850

Brass sheet, engraved
diameter 31.8 cm
accession no. SC147

Sundials of this type usually consist of a double ring with a movable suspension bracket and a horizontal 'bridge' across the centre (in this case, the bracket is fixed by two pins). The outer ring – the meridian ring – has two scales of 90° marked in its upper two quadrants. Divided to each degree and numbered in sixes in *abjad* notation, these scales permitted the use of the instrument at both northern and southern latitudes. The inner ring – the equatorial ring – is joined to the meridian ring by pivots at 0° and 180°, and it can therefore open at right angles to the meridian ring. Its lower section is engraved with two scales of equal-hour divisions, rising from 0 to 17. Each hour is numbered in *abjad* notation and is marked in thirds, that is, at intervals of 20 minutes.

The 'bridge' is pivoted on supports fixed to the meridian ring, and straddlesthe equatorial ring when the latter is folded flat. It carries a sliding element pierced with a small hole and equipped with a knob to aid its accurate positioning. The slider was adjusted to the solar declination, according to either one of the scales marked on the edges of the bridge (a scale of 0°–24°, divided by sixes, on one side; on the other, a scale of zodiacal signs, also divided by sixes). Once this had been done for the day of use, the dial was opened until the equatorial ring lay at right angles to the meridian ring, and the suspension bracket was moved along the latitude scale to the appropriate latitude (the slider is now fixed, at the zero point of the scale, by two pins, probably because an outer, circumferential strip on which it could be moved, was lost). The dial was then suspended from the suspension ring and manipulated by turning the whole dial and the bridge until sunlight passing through the hole in the slider fell on the equatorial hour-scale. This spot of light then indicated the time, the dial being self-orienting.

Typologically the universal equinoctial ring dial belongs in the tradition of the armillary sphere, the armillary ring dial, and the astronomical ring. Its invention is attributed to the English mathematician William Oughtred (1574–1660), who added a description of it to his discussion of the double horizontal dial published in London in 1652; the instrument maker, Henry Wynne, who published a description of this type of dial in 1682, named Oughtred as the inventor on the title page.[1] The universal equinoctial dial was one of the few sundials which, having no compass for orientation and therefore requiring no mounting of gimbals to insulate it from a ship's movement, could be used with facility on board ship, but it was also popular on land. Such dials could be made fairly large while remaining easily portable, and their accuracy increased with size. A number of universal equinoctial dials were made in India during the 19th century, but there was no indigenous tradition of this kind of sundial in Islamic or Hindu astronomy.[2]

1. See Maddison 1969, pp. 44–6, esp. n. 137; Turner 1987, *passim.*
2. See Christie's, 27 September 1990, p. 40, lot no. 190, for an Indian equinoctial ring-dial, of silver, not signed or dated, but of the mid-19th century.

142, closed

142, open

Iranian astrolabes fall into two distinct groups. Those made in the 10th to the early 16th century continue in much the same simple style of the earliest eastern Islamic astrolabes, but the occasional zoomorphic decoration of the rete, some elaboration of the *kursī*, and more numerous scales on the back contribute to a less austere appearance. The script is still Kufic, at least up to the work of Muhammad ibn Ja'far al-asturlabi, known as al-Jalal, who flourished at the end of the 14th and in the first half of the 15th century, and of his son Mahmud. Some 30 years later, astrolabes are already engraved in the cursive *naskh* script, but retain some of the earlier characteristics.[1]

Thereafter, there appears to have been a brief lull in astrolabe-making in Iran, but from the end of the 16th century we may distinguish a second group of astrolabes which can be associated with the Safavid shahs from the time of 'Abbas I onwards. The earliest of these is that made in AH 996 (AD 1587–8), the year of 'Abbas's accession, by Muhammad Amin b. Amirza Khan al-Nakha'i (later known also as al-Qummi). It is fairly plain in design and resembles in certain respects the astrolabes then beginning to be made in Mughal India.

Its successors, however, soon assume the ornate, highly decorated style associated with Safavid Iran. The rete of these astrolabes is a pattern of tendrils, waving between the circles of Capricorn and the ecliptic, bearing leaf-shaped star-pointers. The *kursī* is high, triangular, and either engraved with floral patterns or with religious or dedicatory inscriptions. Likewise, the rim, the back, and even the plates tend to have vacant spaces between essential scales engraved with patterns or inscriptions, sometimes Persian verses. The script is not only *naskh*, but often *nasta'līq*, the characteristic sloping Persian script. The astrolabist, who was sometimes assisted by a 'decorator' or 'engraver', generally signed in a cartouche below the shadow-square on the back. Astrolabes from 17th- and 18th-century Iran are quite numerous; the survival of so many precisely and beautifully worked instruments is rather a reflection of the passion for astrology at the Safavid court which Sir John Chardin comments on (see above, p.189), than of a devotion to astronomical investigation, and the universal presence on the backs of the astrolabes of astrological tables is a testimony to this.

1. See Brieux & Maddison, forthcoming, 'Muḥammad b. Ja'far b 'Umar'; the two astrolabes and two globes known by this maker range in date from AH 796 (AD 1393–4) to AH 834 (AD 1430–31). His father, Ja'far ibn 'Umar ibn Dawlatshah al-Kirmani, is known as the maker of some eight fine astrolabes and globes; see Brieux & Maddison, forthcoming, 'Maḥmūd b. Jalāl'.

143
Celestial globe
Iran, Safavid,
first half of the 17th century

Brass
diameter 17.30 cm
weight 2.05 kg
maker Muhammad Zaman
accession no. SC1282

This highly accurate and finely engraved celestial globe has 39 prominent stars, labelled in Arabic and indicated by inlaid silver points. Although unsigned and undated, the globe's star positions are consistent with those used on a globe, now in the Victoria & Albert Museum, that was produced in AH 1050 (AD 1640–41) by Muhammad Zaman, an astrolabe maker known to have worked in Mashhad during the reign of Shah 'Abbas's successor, Safi I (*reg.*1629–1642).[1] Muhammad Zaman made at least two other celestial globes, although these are not quite as well executed as the one he produced in 1640, and at least seven astrolabes which span the years from 1654 to 1675 or 1678.[2]

The globe in the Victoria & Albert Museum is a fairly precise instrument of approximately the same size as cat.143 and is also made in hemispheres, but it includes a full set of constellation outlines and stars. Although these are lacking on cat.143, it is an even more precisely executed instrument, employing more intricate metallurgical production techniques than those of globes known with certainty to have been made by Muhammad Zaman or under his supervision.

The globe, which lacks the original rings and stand, is constructed in two hemispheres joined along the celestial equator. The weight, and the fact that it is biased when rolled, suggests that the hemispheres were cast with quite thick walls. There is a slightly damaged area near the vernal equinox and some rubbing of the finish in a few places. The surface has been cleaned and varnished fairly recently and lacquered with a gilt lacquer that probably does not indicate the original surface colouration.

Nevertheless, the sphere was executed with great precision, both metallurgically and astronomically. The sphericity is exceptional for a globe made in hemispheres, while the graduation of the ecliptic and equator is unusually precise and the positioning of the stars is consistently accurate in terms of the star catalogues of the day. Moreover, the inlaying techniques are excellent and the calligraphy of the highest quality.

The band of the equator is divided into single degrees with every fifth degree labelled with an *abjad* letter-numeral, numbered continuously beginning from the vernal equinox. The inner edge of the band indicating the celestial equator is inlaidwith a copper wire, while the inner edge of the ecliptic is inlaid with a thin silver wire, alongside which are engraved the Arabic names of the 12 zodiacal houses, written anticlockwise when viewed from the north pole. The ecliptic is divided into single degrees with every fifth labelled by *abjad* letter-numerals, repeating every thirty degrees (i.e., 5°, 10° 15°, 20°, 25°, 30°, 5°, 10°, etc).

Six great ecliptic latitude-measuring circles divide the ecliptic into twelve equal parts (the zodiacal houses). The equinoctial colure, the Tropic of Cancer, the Tropic of Capricorn, and the two 'polar circles' (circles centred at the celestial poles with the circumference passing through the ecliptic poles) are each indicated by single engraved circles. A rod passes through holes drilled at the celestial poles.

The north celestial pole and polar circle, the equinoctial colure, and the greatest distance between the ecliptic and the equator at the solstices are given Arabic labels. The labelling of the stars is given in Appendix III.

1. London, Victoria & Albert Museum, Department of Metalwork, inv.no.M.827–1928; see Savage-Smith 1985, p.226, no.16, and p.48, fig.21.
2. One globe, now in a private collection in Kuwait, was made in AH 1054 (AD 1644–5); the second globe is undated and is now in Cairo, Museum of Islamic Art, inv.no.15266; see Savage-Smith 1985, p.226, no.17, and p.250, no.64. For the astrolabes, see Savage-Smith 1985, p.303, n.164. Brieux & Maddison, forthcoming, 'Muḥammad Zamān 1–10', and 01 and 02 (both fakes), lists the globes and astrolabes; Muhammad Zaman 10 is not signed by Muhammad Zaman, but by Muhammad Zaman 3.

143, shown with the north celestial pole at the top

144

Planispheric astrolabe

Iran, dated AH 1060 (AD 1650)

Brass, sheet and cast, cut and engraved
diameter 11.4 cm *height* 14.6 cm (excluding shackle and suspension ring) *thickness of mater* 0.7 cm
maker Muhammad Mahdi al-Yazdi
accession no. SCI161

This typically beautiful Safavid astrolabe is finely engraved by one of the outstanding makers of the period. His signature appears in a cartouche on the back, below the shadow square, 'Decorated by Muhammad Mahdi al-Yazdi'. Muhammad Mahdi was the son of Muhammad Amin al-Yazdi, and the nephew of Muhammad Khalil al-Isfahani, both well-known astrolabists, the sons of Hasan 'Ali.[1] Muhammad Mahdi signed sometimes *ṣanacahu* ('he made it'), sometimes, as here, *nammaqahu* ('he decorated it') and sometimes *naqashahu* ('he engraved it'); he decorated at least one astrolabe made by his uncle. The six known dated instruments by him range from AH 1059 (1649–50) to AH 1083 (AD 1662–3), the present instrument being dated AH 1060 (AD 1650).

The rete is of an intricate, detailed, foliate floral pattern, typical of Muhammad Mahdi's style, and is for 44 stars. The inscriptions are engraved in relief. The first half of a long inscription in verses, along the Capricorn band, reads, *Az tīz-'aql justam tārīkh-i ān, biguft: 'Āyīnah-ī Sikandar u jām-ī jahān-numā-st* ('I enquired the date from [a man of] sharp intellect, he said: It is the mirror of Alexander and the cup that shows the Universe'). The second half is a chronogram giving the date, AH 1060 (AD 1650).[2]

There is a turning knob on this band. The *kursī* was worked *à jour*, with four leaf-shaped voided areas, characteristic of the maker's work. A cartouche in the centre bears the Qur'anic inscription 'His Throne doth extend over the heavens and the earth' (II, verse 255). The numeration of the scale of degrees on the limb, divided by fives, is, like most of the inscriptions on this instrument, engraved in relief. Around the rim is a doxological inscription.

There are five plates for the latitudes 22° 0′ and 32° 0′; 25° 0′ and 34°; 30° and 35° 0′; 33° 0′ and 36°; and 40° with a tablet of horizons – the azimuths are drawn above the horizon and there are lines for unequal and Babylonian hours. As is usual, the latitude for which the projection on the plate is drawn is engraved below the horizon line, in the centre, but here the number of hours and minutes of daylight during the longest day in that latitude is also given. This is the common layout on eastern astrolabes.

The mater is engraved as a gazetteer of the longitude, latitude and *inḥirāf* of 50 places. Of the quadrants on the back, one is divided as a sine quadrant, with radial lines from the centre at five-degree intervals (upper left). Another has – superimposed on the arcs of the signs of the zodiac – seven curves of meridian solar altitudes throughout the year for different latitudes and nine curves of azimuths of the qiblah for different places (upper right). The lower two quadrants are engraved with a semi-circular astrological table correlating the signs of the zodiac, the lunar mansions, and the terms and faces of the planets, within which there is a shadow square with a table of triplicities; at the limb are cotangent scales. On the back, the *kursī* bears a circular depression, which contained a small compass, probably with a bird-shaped needle, and directions of the qiblah marked on its bezel, as is found on other astrolabes by Muhammad Mahdi al-Yazdi. At the lower edge of the limb is a cartouche with a quotation from the *Gulistān* ('Rose Garden') by the 13th-century Persian poet Sa'di of Shiraz: *Gharaz-i naqshī-st k-az mā bāz mānd, kih hastī-rā namībīnam baqā'ī* ('The object of engraving is that it should live after us for I do not see permanence in existence'. This is the first line of the second *qiṭ'ah* of the preamble).

The alidade and, probably, the pin are original; each end of the alidade is voided with a leaf-shaped design, similar to that on the *kursī*.

The English traveller, Sir John Chardin FRS, met Muhammad Mahdi's father, Muhammad Amin, when in Isfahan in the years 1671 to 1673 (see above, p.189). It is possible that Chardin or members of his entourage introduced Muhammad Amin or other astrologer/astrolabists to some Western European astronomical material. Specifically, Muhammad Mahdi made close copies of French polar stereographic constellation-maps of the northern and southern hemispheres on either side of a plate of an astrolabe (and on plates of at least two others), serving partly as substitutes for the plate of 'ecliptic' coordinates. The original map used by Muhammad Mahdi was either that printed *circa* 1650 by the Parisian mapmaker Melchior Tavernier, or a very similar map printed, in 1650, just across the Seine by Antoine de Fer. It is possible that either or both maps were brought to Iran by Melchior Tavernier's brother, the traveller, Jean-Baptiste Tavernier, who made several journeys to the Near East, including Iran.[3] There are other examples of Safavid astrolabe-makers' awareness of French astronomical material; for example, the anonymous universal astrolabe, engraved with an orthograpic projection, as described in Juan de Rojas' *Astrolabium*, Paris, 1550 and 1551, made for Shah Husayn I (*reg.* 1694–1722).[4]

1. Brieux & Maddison, forthcoming, 'Muḥammad Mahdī al-Yazdī', 'Muḥammad Amīn al-Yazdī' and 'Muḥammad Khalīl al-Iṣfahānī'.
2. Other astrolabes by Muhammad Mahdi bear chronogram dates where the letters of the inscription, counted as *abjad*, give the date. A Mughal astrolabe of AD 1813, which refers to the astrolabe as superior to the mirror of Jamshid, is described by Morley (1856, pp.39–41). The mirror, cup or globe of Jamshid represented the real and supernatural world, and appears, importantly, in Part I (AD 1191) of Nizami's *Iskandar-nāmah*, which relates the medieval legend of Alexander the Great. See Clarke 1881, pp.247–50, canto XXIII, and pp.527–39, cantos XLII and XLIII; Reinaud 1828, II, esp. pp.418–9; Baltrušaitis 1978, p.72
3. See Savage-Smith 1992a, pp.65–7; and p.175, note 24, above.
4. Savage-Smith 1992a, p.38, n.79, and the references there given; the astrolabe is in the Hermitage, St Petersburg, no.VC512 and is illustrated in Maistrov 1968.

145

Planispheric astrolabe

Iran, *circa* AD 1660

Brass sheet, cut and engraved
diameter 7.4 cm *height* 9.7 cm (excluding shackle and suspension ring)
maximum thickness of mater 0.5 cm
accession no. SCI159

This small astrolabe, much of it well-engraved in relief and the scales finely divided, recalls the much more elaborate work of Muhammad Mahdi as seen in cat.144, even to the cut-out 'leaves' at the ends of the alidade, but it is unlikely to be his work. The delicate foliate tracery of the rete marks 18 stars. The *kursī* is engraved in relief with foliate designs on the front and back. There are plates for the latitudes 30° and 32°; 33° and 37°; 35° and 36°; and 34°, with a tablet of horizons.

The mater is engraved with a gazetteer of the longitude, latitude and *inḥirāf* of 17 places. On the back there is a sine quadrant on which is superimposed – unusually for an Iranian astrolabe – a horary diagram, used with the scale on the alidade as a sundial; a quadrant of arcs of the signs of the zodiac with curves of the meridian altitudes for Yazd and Qazvin (these curves are normally inscribed with latitudes rather than place names); and of azimuths of the qiblah for Herat, Mashhad Isfahan and Baghdad. In the lower half, there is a shadow square with a table within, and, on the limb, cotangent scales. The alidade, which is original, is engraved with declination and horary scales. The pin and horse are also original.

145, rete, pin and horse

144

145, front of mater, plates and rete

145, back of mater with alidade

146

Planispheric astrolabe
Iran, 17th century

Brass, sheet and cast, cut and engraved; later ivory suspension ring; the pin and horse replaced by a brass bolt with an ivory nut
diameter 9.7 cm *height* 12.6 cm (excluding shackle and suspension rings) *thickness of mater* 0.9 cm
Accession no. SC1160

The foliate pattern of the rete for 33 stars of this astrolabe is reminiscent of that on cat.145, but the remainder of the instrument is more simply engraved, without decoration. The *kursī* is high and plain. There are four plates, for latitudes 32° and 33°; 35° and 36°; 34° and 37°; and 30°, with a tablet of horizons.

The mater is engraved as a gazetteer of the longitude, latitude and *inḥirāf* of 28 places. On the back there is a sine quadrant (upper left); the arcs of the signs of the zodiac, on which are superimposed curves of the azimuths of the qiblah for Medina, Basra, Isfahan and Tus. Below are a shadow square, within which is an astrological table of triplicities. The alidade is original, and is engraved with a declination scale and a horary scale, although there is no horary diagram on the back.

147

Planispheric astrolabe
Probably Iran, 18th century

Brass, sheet and cast, cut and engraved
diameter 17.9 cm *height* 24.1 cm (excluding shackle and suspension ring)
thickness of mater 1 cm
accession no. SC135

The rete of this instrument is of an elaborately decorative foliate pattern with named star-pointers; the ecliptic circle is divided to each degree and numbered by sixes. The limb is divided to each degree and numbered by fives. The five plates are engraved for latitudes 30° and 39°; 32° and 33°; 34° and 35°; 36° and 37°; and 24°, with a tablet of horizons on the reverse. On the back, the scale on the limb is divided to each degree and numbered by fives. It begins in the upper-left quadrant, at the horizontal line, but continues beyond 90° in an anticlockwise direction to form a scale of 360°. Within the scale on the limb there is an eccentrically-placed zodiacal scale (but with no associated calendar-scale), and within that scale, a sine quadrant with its own 90° scale on which is superimposed an unequal-hour diagram (upper left), a series of meridian altitude graphs on the arcs of the signs but with no place-names engraved (upper right), a shadow square, and astrological tables, including the 28 lunar mansions. The *kursī* is engraved on both sides with a crude floral pattern against a textured background; the same texturing was effected on the ecliptic-circle and on the Capricorn band on the rete.

At the bottom of the back, between the ecliptic scale and the limb-scale, is the name 'Abd al-A'immah, followed by the numeral 8, the meaning of which remains unexplained. This signature, if indeed it be a signature, is not the usual form of that of the famous Iranian astrolabist, 'Abd al-A'immah, and for that and stylistic reasons, it would be inadvisable to attribute this astrolabe to him. However, it is much better made than many of the crude 'Abd al-A'immah fakes,[1] and perhaps it belongs to that class of 'fake' postulated by Gingerich and Saliba as attempts to reproduce the prestigious works of makers such as 'Abd al-A'immah and 'Abd al-'Ali.[2]

The alidade bears declination scales; the horse isa modern replacement.

1. Brieux & Maddison, forthcoming, ''Abd al-A'imma'.
2. Gingerich, King & Saliba 1972, *passim*; see above, pp.196–6

147, detail of purported signature

146

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Non-functional planispheric astrolabe

Iran, after 1778

Brass, sheet and cast, cut and engraved
diameter 12.2 cm *height* 17.8 cm (excluding shackle)
thickness of mater 0.8 cm
Open-fronted plywood case, 20.1 × 14.2 × 1.1 cm, covered with red leather and set with two leather seal impressions, 2.6 × 24 cm (upper) and 4 × 5.7 cm (lower)
accession no. SCI19

This small astrolabe belongs to the class of 'fake' or 'copy' that was useless astronomically but was the product of a skilful metalworker. The explanation may be that it – and other comparable items produced in a style derived from Safavid models – was produced for an Iranian clientele, for as A. Kržiž wrote in 1805 there were those in Tehran who loved to have an astrolabe 'in their sight, although they could not understand one iota of it …'

This astrolabe appears to fit the description well, for it has an open-fronted display-box, of plywood covered in red leather, with a recess cut to fit the instrument; two pieces of leather, shaped like the seals the impressions of which they bear, have been laid into the surface of the recess. The upper impression is painted gold and shaped like a palmette. It reads 'The servant of science, Muhammad Khan' and is dated AH 1191 (AD 1777–8). The lower impression, painted green and a lobed medallion in shape, contains the *basmalah* ('In the name of God, Most Gracious, Most Merciful') in a central cartouche, which is framed by a quotation from surah LXVIII of the Qur'an (*al-Qalam*, 'The Pen', from verse 51): 'And the Unbelievers would almost trip thee up with their eyes when they hear the Message …'. Both seals were engraved in *nasta'līq*.

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Planispheric astrolabe

Iran, *circa* AH 1210 (AD 1795)

Brass, sheet and cast, cut and engraved
diameter 9.3 cm *height* 12.1 cm (excluding shackle and suspension ring)
thickness of mater 1.1 cm
maker Hajji 'Ali ibn Sadiq Qummi
accession no. SCI271

This beautifully made small astrolabe is one of seven by Hajji 'Ali ibn Sadiq Qummi, an Iranian astrolabist of the late 18th century.[1] Though undated, the work closely resembles that of another astrolabist, Hajji 'Ali,[2] who produced at least 24 numbered astrolabes, seven of which are dated, the earliest from AH 1203 (AD 1788–9), the latest, which carries the number 16, from AH 1210 (AD 1795–6). Indeed, the astrolabes of both makers are so similar in size and design that it has been suspected that they are by the same maker, or from the same workshop.[3] However, whereas Hajji 'Ali signed himself thus in a cartouche below the shadow square, engraving the date and usually the opus number, 'Ali ibn Sadiq always left the cartouche blank, and placed his signature on the limb, at the very bottom of the back. Only on cat.149 and on that in the Museum of Islamic Art, Cairo,[4] did he use the title Hajji, and only on the astrolabe last known to be in a private collection in Hanover did he use the *nisbah* Qummi (' the man from Qum').[5] Both astrolabists use the noun, *'amal* ('work') in their signatures. On cat.149 the signature is placed in a cartouche at the bottom of the back of the astrolabe. It is not dotted, and there is an unexplained mark or letter, similar in shape to a *madda* over the *bā'* of *ibn*.

Although it is not certain whether Hajji 'Ali ibn Sadiq was the same person as Hajji 'Ali, the present astrolabe may be assigned a date of about 1795 on comparative grounds.

The rete is of the foliate pattern with pointers for 29 stars. The script of the signs of the zodiac on the ecliptic circle, of the *abjad* letter-numerals on the limb, and of the place-names in the gazetteer, was engraved in reserve against a patterned ground.

There are four plates of the usual Iranian design. One is engraved for latitude 29°, with a tablet of horizons on the reverse; the others are engraved for latitudes 30° and 36°; 32° and 34°; and 37° and 38°. There are lines for Italian hours, as well as the usual unequal-hour lines.

The mater is engraved with a gazetteer of the longitude, latitude, and *inḥirāf* of 34 places. The back is typical of Iranian astrolabes of the 17th and 18th centuries: one quadrant is divided as a sine–cosine quadrant (upper left); another bears graphs of meridian altitudes of the Sun for seven different latitudes, and of azimuths of the qiblah for Shiraz, Baghdad, Isfahan, and Tus (upper right); below these quadrants are a shadow square, an astrological table of terms and faces of the planets and of the 28 lunar mansions, with scales of cotangents on the limb. The alidade is engraved with declination and horary scales. The *kursī*, front and back, bears an elegant floral design.

1. Brieux & Maddison, forthcoming, ''Alī b. Ṣādiq Qummī'. The numbers following this name, and that of 'Alī, in the following notes refer to the numeration in this work.
2. Brieux & Maddison, forthcoming, ''Alī'.
3. Compare, for instance, the *kursī* on ''Alī b. Ṣādiq 5', now in the Rijksmuseum voor de Geschiedenis der Natuurwetenschappen, Leiden; and that on ''Alī 1', now in the Bayerisches Nationalmuseum, Munich. They are unusually worked *à jour*, and are similar in many respects, but the more common designs used by both makers are never identical.
4. ''Alī b. Ṣādiq Qummī 4'.
5. ''Alī b. Ṣādiq 2'; Mayer 1956, p.43, no.II.

148, with display case

149, front of mater, plates and rete

149, back of mater with alidade

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Planispheric astrolabe

Probably Iran, dated AH 1234 (AD 1818–19)

Brass sheet, cut and engraved
diameter 21.9 cm
maker Muhammad Akbar
accession no. SC16
published Gunther 1932, I, pp.169, 170, fig.83, pl. XLIV, no.58; Mayer 1956, p.62, 'Muḥammad Akbar I'; Gibbs, Henderson & de Solla Price 1973, no.58; Turner 1985, pp.104–7, figs 85–7, no.10.[1]
provenance Samuel Verplanck Hoffmann Collection, New York, no.11; New York Historical Society, acc.no.1943.199; National Museum of American History, Washington DC, acc.no.322.499; Nissen Collection; Time Museum, Rockford, Illinois, inv.no.2393; Christie's, London, 9 April 1975, lot no.103

The ornate foliate-patterned rete of this instrument has named pointers for 13 stars; the names of the signs of the zodiac on the ecliptic circle are engraved in reserve against a lightly textured ground. The degree scale on the limb has, unusually, every fifth division indicated by a dot superimposed on the middle of the division-line; it is numbered in fives in *abjad* notation, also reserved against a lightly textured background set with scrolls.

There are six plates: five are engraved with stereographic projections (almucantars every two degrees) for latitudes 22° and, perhaps, 32°; 29° and 36°; 30° and 34°; 37° and 43°; and 38°, with a tablet of 20 horizons; the sixth plate, apparently unfinished, is engraved on one side with a rectangular grid – perhaps for qiblah determination – and on the other only with the lines of the Tropics and the Equator. The plates are variously engraved with hour-lines for unequal, Babylonian and Italian hours.

The mater is engraved with a gazetteer of the longitudes, latitudes and *inḥirāf* of 70 places. On the back are the usual scales of [0°]–90° in the two upper quadrants: of these, that on the left is engraved as a sine–cosine quadrant, that on the right with the arcs of the signs of the zodiac with graphs of meridian solar altitudes for eight latitudes from 28° to 42°, and graphs of azimuths of the qiblah for Shiraz, Baghdad, Isfahan, Tus and Mashhad. In the lower quadrants are a shadow square containing an astrological table and a table of the 28 lunar mansions, and of the terms, faces, and limits of the planets. Between the shadow square and the latter table there is a cartouche with the inscription 'The work of Muhammad Akbar, 1234 [AD 1818–19]'. There is an alidade, engraved with declination scales, and a pin and a horse.

This instrument is in the Safavid tradition of highly decorated astrolabes, though it is late and its engraving is somewhat less rich. The front of the *kursī* bears the inscription 'It was completed to the order, which has the power of destiny, of … Mahmud Mirza Qajar' and on the back 'He is God – May He be exalted! It was completed to the order, which has the power of destiny, of the most mighty Prince a wish of the very great Prince, in the town of Nihawand, which resembles Paradise, by this servant of the Court, Muhammad Akbar Afshar.'

A second astrolabe by Muhammad Akbar has been recorded; it is dated AH 1234 (AD 1818–19).[1]

1. See also Brieux & Maddison, forthcoming, 'Muḥammad Akbar 1'.
2. Cambridge, Whipple Museum of the History of Science, inv.no.599; Brieux & Maddison, forthcoming, 'Muḥammad Akbar 2'.

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A globe with astrolabe components

Iran, the last Wednesday of Jumada I 1212 (15 November 1797)

Leaded tin brass (globe);
leaded brass (stand)
diameter 11.32 cm
diameter of horizon ring 11.4 cm inner, 13.8 cm outer
diameter of lower ring base 9.7 cm outer, 7.5 cm inner
height of stand 12.1 cm
weight 1.15 kg (globe); 0.55 kg (stand)
maker Muhammad Sharif ibn Muhammad Rida
accession no. SCI 155

This finely engraved instrument combines the properties of a celestial globe with astrolabe components to form an instrument of unique design. Its intended function can only be conjectured.

In an ornate four-line inscription written in the southern hemisphere immediately below the Tropic of Capricorn, the maker gives his name as Muhammad Sharif ibn Muhammad Rida and states that he completed its manufacture on the last Wednesday of the month of Jumada I in the year 1212 (15 November 1797). The year is indicated by the word *gharīb*, the numerical values of its letters yielding the sum 1212. In the space below the block inscription, the numerals 1212 were inscribed beneath the word *gharīb*, possibly at a later date in an effort to explain the year. No other instruments or objects by this maker are known to be preserved.

Its calligraphy suggests an Iranian workshop, and the gazetteer given on the horizon ring is restricted to an area in Azerbaijan and north-west Iran to the south and south-west of the Caspian Sea. Its method of construction – a seamless sphere cast by *cire perdue* – is, however, characteristic of Indian workshops.

It is tempting to speculate that the otherwise unknown maker may have been the astronomer Muhammad Sharif sent to Europe, apparently about 1730, by Sawai Jai Singh II (d. 1743) from his court at Delhi to search for European instruments and astronomical tables. After a stay in Europe, Muhammad Sharif went to the Seychelles Islands where he is said to have mapped some of the southern constellations unknown to medieval astronomers. According to the writer of the appendix to the Sanskrit translation of Ptolemy's *Almagest*, who is our source of information regarding Muhammad Sharif, it was due to the latter that 'globes which originated in the land of the Europeans were brought from Surat'.[1] Presumably such globes then were transported from the port of Surat on the Gulf of Cambay to the northern cities of Delhi, Jaipur, Benares (Varanasi), Mathura and Ujjain where Sawai Jai Singh had established observatories. The design of cat.151 does suggest an exposure on the part of the maker to some of the European spherical dials that were particularly popular in Germany in the 18th century.[2] The globe's late date, AH 1212 (AD 1797) makes it unlikely, however, that its maker was the same Muhammad Sharif who was sent to Europe.

The maker more likely was the son of one Muhammad Riza, chief astrologer (*munajjim-bāshī*), who composed a short treatise on astronomy for the Qajar ruler Fath 'Ali Shah, (*reg.*1797–1834).[3] The instrument was made in the year that he acceded to the throne and could well have been an accession gift.

That the Qajar court in Tehran had other unusual and eye-catching instruments is documented by the report of Isabella Bird. In her travels in Iran in the 1880s she saw in the Shah's 'museum' in Tehran a gold globe, 20 inches in diameter, in a gold stand and meridian ring, set with rubies. On the globe itself, according to her description, the equator and the ecliptic were marked with large diamonds, while the oceans were represented by emeralds and the countries outlined in rubies, with the exception of Iran which was outlined in diamonds.[4]

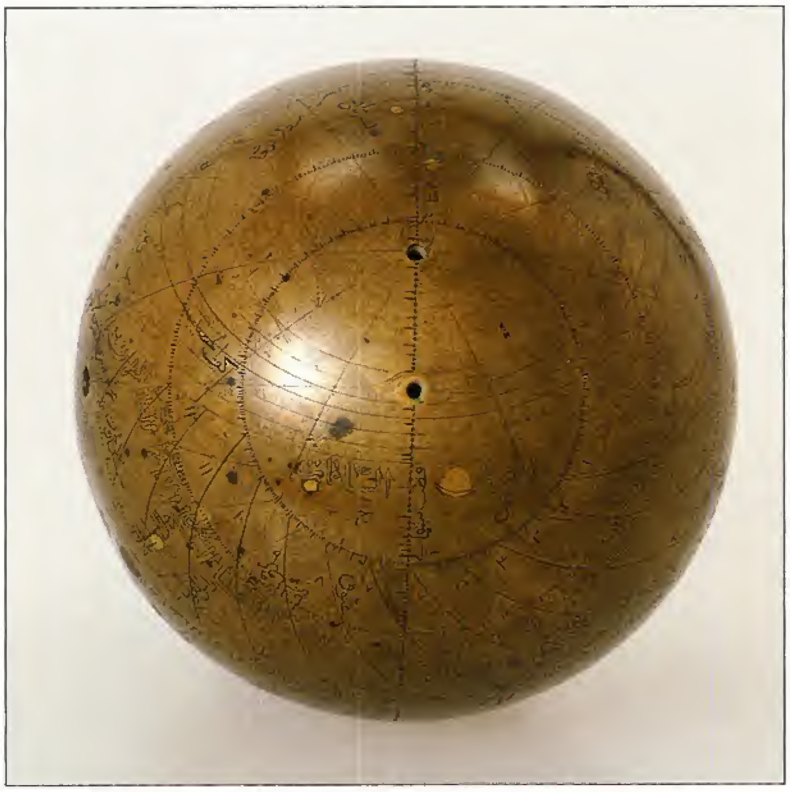
In addition to having the basic features of a celestial globe with 39 prominent stars, there are certain design-features unique to this particular instrument. A large hole, labelled *makānah-i shākhiṣ* or 'place of the gnomon', has been drilled about 18 degrees north of the vernal equinox along the equinoctial colure. A gnomon placed in this hole could possibly allow the celestial globe to function more readily as a spherical elevation or altitude dial. At both the north and south poles there have been engraved designs that essentially reproduce two astrolabe plates made for the specified geographical latitudes of 30° and 72°. It is not apparent what purpose was served by inscribing onto a sphere two planispheric celestial maps representing stereographic projections of the celestial coordinate systems onto a flat surface. It is possible, however, that if an openwork cap, with a circumference equal to that of the tropic circles on the globe, had been designed to resemble a rete, or open star map, on a planispheric astrolabe, to be placed over one of the celestial poles, then the instrument could have served as a partial spherical astrolabe.[5] The upper

rings, of which there appear to have been three, are now missing, and it is possible that additional fixtures have also been lost. Had these survived, they would have assisted in the interpretation of this instrument.

It is curious that the latitude of 30° North found on the 'astrolabe plate' engraved at the north celestial pole does not correspond to any latitude given in the gazetteer on the horizon ring. The gazetteer of 16 cities indicates a very limited area of intended use: from Nakhijevan in the west to Isfahan in the east, and from Tiflis (Tbilisi) in the north to Sumayram and Isfahan in the south, with a length of daylight from about 15 hours at the northern latitudes to 14 hours and 3 minutes in the south. This discrepancy suggests that the horizon ring was possibly designed for another globe, or that the engraved planispheric maps of the coordinate systems were added later, perhaps for decoration. However, it appears that the stereographically projected coordinates for latitudes 30° and 72° were engraved when the rest of the globe was constructed.

The choice of 72° for the set of coordinates inscribed at the south pole was probably determined by the fact that at 72° – or about 5½° above the polar circle – the entire Sun would be seen at the summer solstice to be above the horizon for a 24-hour period. This latitude also has the longest night-time period at the winter solstice, for no fraction of the Sun's disk appears at or above the horizon at the time of the winter solstice. The arctic circle, or latitude 66° 30′, is customarily regarded as the latitude at which the longest day occurs, but at that latitude the full disk would not appear above the horizon for the entire twenty-four hour period at the summer solstice. Plates made for planispheric astrolabes do occasionally have plates designed for 72°, though plates for 66° 30′ are more common.[6]

On the sphere, the ecliptic is graduated by single degrees indicated by dots with every fifth a short line and labelled in *abjad* letter-numerals, repeating every 30 degrees. The names of the zodiacal houses are inlaid in silver alongside the ecliptic. The equator is similarly graduated but numbered continuously from the vernal equinox. The tropic circles and the solstitial colure are graduated in a similar manner. There are also lesser circles parallel to the equator, placed at 12° and 20° either side. Six great circles at right angles to the ecliptic, ecliptic latitude-measuring circles, demarcate the twelve zodiacal houses. In the houses of Virgo, Libra, Pisces and



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Aries there are arcs of circles parallel to these that extend between the circles at 20° either side of the equator.

The two equinoxes, both solstices, the solstitial colure, the equinoctial colure, and the two celestial poles are all labelled in a large double-outlined script similar to that of the signature inscription. Also in a similar script the greatest obliquity or distance of the ecliptic from the equator (*mayl kulli*) is labelled and said to be 23° 30′ 17″.[7]

Centred at the north celestial pole, with the tropic of Cancer as the circumference, there is inscribed a version of an astrolabe plate designed for a latitude of 30°. In fact, the design is labelled just as if it were an astrolabe plate: 'Latitude 30°, Hours [of the longest day] 13 [56 minutes].' Almucantars (circles of equal altitude) are inscribed every six degrees.[8] Also on this portion of the globe are circles representing the tropic of Cancer and the equator as drawn using stereographic projection on an astrolabe plate. The east-west points along the equinoctial colure are labelled. Arcs of unequal hours are labelled one through twelve in both words and numerals, whereas the arcs of equal hours are labelled one through fourteen.[9]

At the south celestial pole, with the tropic of Capricorn as the circumference, another form of astrolabe plate is inscribed. This one is labelled as the latitude of 72° with a longest day of 24 hours. The almucantars appear to be indicated for every three degrees and there are arcs of unequal hours drawn. There are no lines of equal azimuth nor an obvious equator.

X-rays show that the sphere was cast in one piece. Beneath the signature inscription there is a rectangular plug (1.2 × 1.7 centimetres) made of the same alloy as the rest of the sphere and held with solder. Several round chaplets of a different alloy are visible, ranging in size from 0.4 to 0.2 centimetres in diameter. The sphere rattles when shaken due to loose bits from the casting process, and it is very biased so that the large hole is always at the top when the sphere is allowed to move freely on a horizontal surface. The large hole intended for a gnomon is 0.4 centimetres in diameter, while the north ecliptic and equatorial poles have holes of 0.25 centimetres diameter. A rod runs through the globe at roughly right angles to the equator.

The horizon ring and stand appear to be contemporary with the sphere. The top of the ring has four round holes, each labelled with one of the cardinal points; the intermediate quadrants are labelled northwest, southwest, southeast, and northeast. The holes at the north–south points would have held a semicircular ring serving as the meridian ring, and the east–west holes a similar ring acting as the zenith ring; both are now missing. To the underside of the two points marked north and south there is attached a semicircular arc supporting the horizon ring; it is graduated by single degrees with every fifth labelled from the points of attachment. Holes are drilled in this arc at different points labelled latitudes 10°, 15°, 30°, 32°, 37°, 45°, 52°, 65°, 70° and 75°. The horizon ring is also supported by a second, ungraduated, arc attached under the east–west points. These two supports are attached to a stand formed of two crossed semicircular bars resting on an undecorated ring base.

The top of the horizon ring is graduated by single degrees, with every fifth labelled in *abjad* letter-numerals in non-consecutive segments of 90° beginning at the north-south points. At 47°–49° anticlockwise from the north-south points there are two notches cut for another ring, now missing, which might have supported an openwork cap or rete. On the underside of the horizon ring there are engraved the names of eight cities, each with its longitude, its latitude, its azimuth of the *qiblah* (all rounded to the nearest degree), its direction of the azimuth of the *qiblah* with respect to the four cardinal points,[10] and the length of its daylight on the longest day. The eight cities are Qazvin, Golpayegan, Sumayram, Isfahan, Kashan, Qom, Tehran and Manzariyeh. The gazetteer is continued on the outside edge of the horizon ring, where eight additional cities and their attributes are listed, though not as carefully inscribed: Tiflis (Tbilisi), Bakouyeh, Ardabil, Nakhijewan, Maragheh, Tabriz, Ganjah and Varzaqan.

The 39 stars, shown by inlaid silver points, are labelled (see Appendix III).

1. Pingree 1987b, p.317. The translation was completed in 1732 and the earliest dated copy was completed in 1803; see Pingree 1987b, p.315.
2. See the examples made by Hans Volmar in Nuremberg and Johann Willebrand in Augsburg, now in Cambridge, Whipple Museum of the History of Science, inv.nos 660 and 860; see Bryden 1988, nos 250 and 251. For a 16th-century German example see the unsigned globe dial in Oxford, Museum of the History of Science, Lewis Evans Collection. inv.no.G.562,.
3. See Storey 1972, p.97.
4. Bird 1988, p.285.
5. For the spherical astrolabe see Maddison 1962.
6. For examples of astrolabes with plates designed for 72°, see Gunther 1932, I, pp.183, 222, 225, 242, 251, and 263; and Gibbs & Saliba 1974, p.128.
7. A similar stated value, with a precision far greater than the nature of this globe would allow, is given on a celestial globe completed on 23 Jumada I 1221 (9 August 1806) by Muhammad 'Ali al-Husayni and now in Cairo, Museum of Islamic Art, inv.no.3774; see Savage-Smith 1985, pp.254–5, no.73.
8. There are no lines of equal azimuth, however, possibly because they would have interfered with the nearby ecliptic latitude-measuring circles.
9. For an illustration of an astrolabe plate displaying similar stereographically projected coordinates for the latitude of 30°, made about 1795 by the prolific astrolabe-maker named Hajji Ali, see Gibbs with Saliba 1984, p.78. For Hajji 'Ali, see above, cat.149.
10. In this case, only those in a southwest direction are given.

151, with stand

Andalusi and Maghribi astrolabes

The earliest astrolabes from eastern Islam are followed closely in time by those from al-Andalus (Muslim Spain) where, during the reign of 'Abd al-Rahman II (Córdoba, AD 822–852), cultural influences from eastern Islam began to penetrate the Umayyad kingdom. Al-Hakam II (*reg.* 961–976), especially, patronized the sciences, but there followed a period under his successor when many of the ancient sciences were considered heretical and books were burnt. The situation did not improve until the beginning of the 10th century AD. The author of an early Andalusi treatise on the astrolabe, Ibn al-Saffar, left Córdoba with his son shortly after the beginning of the civil war (*fitnah*) which saw the end of the Umayyad kingdom some 30 years later, and the dispersal of books and scholars throughout Muslim Spain. Ibn al-Saffar's brother, Muhammad ibn al-Saffar, was the maker of the earliest known dated Andalusi astrolabe, that of AH 417 (AD 1026–7), now in the Royal Scottish Museum, Edinburgh.[1] Sa'id al-Andalusi said that he was celebrated for his skill in the construction of astrolabes and that before him no one in Andalusia had known better than he how to construct this instrument.[2]

Probably because of the master–apprentice system, astrolabists tended to be conservative in the style of their products. In each distinct period and region of Islam – as indeed in medieval and 16th-century Europe – the earliest astrolabes set a pattern which is followed with little overall variation throughout the period during which that particular cultural area flourished. This absence of eclecticism results in most astrolabes being immediately recognizable as to their period and geographical origin. In Muslim Spain, the earliest astrolabes not unexpectedly have much in common with the early eastern Islamic instruments described above, but the very earliest known to us already have a distinctive style which persists even on astrolabes made in North Africa in the 18th century and later, after the extinction of the Islamic workshops in Spain, in the wake of the *Reconquista*, the fall of Granada in 1492, and the expulsion of the 'Moors'.

The *kursī*, except on some late Maghribi astrolabes, is low and usually undecorated, but it sometimes retains the two holes.[3] The star-pointers are less severe, and soon are worked *à jour*, springing from bases studded with silver or brass knobs (presumably to assist identification in the dark); eventually they may be found reduced to fine wavy pointers. The rete tracery often includes a 'Moorish' arch, or other motif distinctive of its origin. Apart from the presence of lines indicating the times of prayer on the plates, a noticeable difference in the design of the plates is that the tablet of horizons assumes a characteristic form; it is not quadripartite as in Eastern astrolabes. On the back is a zodiac–calendar scale that correlates the Sun's position in the zodiac with the Julian calendar; and the scales of degrees are sometimes notched at intervals to enable them to be read in the dark. The alidade is 'straight', that is to say, the fiducial (diametrical) edge is along one side of a continuous rule, not 'staggered', as was common in the East, with the fiducial edge along opposite sides of two 'half'-rules symmetrically disposed on either side of the diameter. Perhaps most characteristic of all is the decorative western Kufic script, which even in its early and less mannered form produces a more ornate effect than the simple Kufic used on the contemporary eastern Islamic instruments.

In his 'Book of the Categories of Nations' (*Kitāb ṭabaqāt al-umam*), written in the course of the year AD 1068, Sa'id al-Andalusi concludes his history of mathematics in Muslim Spain with the following words: 'These are the best-known scholars who worked in the science of mathematics in al-Andalus. There were others that I have not mentioned either because I did not know of them or of their contribution, although their names are well known in al-Andalus.

During our present time, there are many young scholars who have distinguished themselves in the study of philosophy [sc. the sciences derived from the Greeks, as opposed to the traditional Islamic Sciences] and demonstrated great energy and ability to acquire a knowledge of most of its branches. Those of them who live in Toledo or around it include Abū al-Ḥasan 'Alī ibn Khalaf ibn Aḥmar al-Saydalānī [the pharmacist], Abū Isḥaq Ibrāhīm ibn Yaḥyā al-Naqqāsh, known by the name Walad Azzarqali, Abū Marwān 'Abd Allah ibn Khalaf al-'Istijī, Abū Ja'far Aḥmad ibn Yūsuf ibn Ghālib al-Tamlākī, 'Isā ibn Aḥmad al-'Ālim (the scholar), and Ibrāhīm ibn Sa'īd al-Sahlī, the constructor of astrolabes.'[4]

Sa'id then selects for notice two scholars from Zaragoza and three from Valencia. The Toledo list quoted above is a distinguished one. The first two names are those of the most famous astronomers of Muslim Spain, 'Ali ibn Khalaf, and Sa'id's pupil, Ibn al-Zarqellu, the Azarchiel of medieval Christian Europe, the compiler of the Toledan astronomical tables, the inventor of instruments and water-clocks. It is to some extent a testimony to the importance attached in Muslim culture to the makers of astronomical instruments, especially astrolabes, that among the short list of six names should be that of an astrolabist, Ibrahim ibn Sa'id ibn Asbagh al-Ansari al-Sahli *al-wazzān* (or *al-mawazīnī*). His first *nisbah* means that an ancestor was one of the Helpers of the Prophet, the second means 'from the (Valencian) plain', the third 'the scales or balance man'. He worked both in Toledo and Valencia, and some five or six instruments by him are known, dating from AH 459 (AD 1067) to at least AH 478 (AD 1086), all astrolabes, except for a celestial globe made together with his son.[5] From the very year (AH 460/AD 1068) in which Sa'id al-Andalusi placed Ibrahim ibn Sa'id's name among those of the outstanding contemporary mathematical scholars in Toledo, there survives an astrolabe made by Ibrahim in that city, with the maker's signature written in western Kufic script on the back.

On the back of this astrolabe may also be seen the characteristic western Islamic zodiac–calendar scale (0° Aries = 14 March), and shadow-square. The rete, in the classic Andalusi–Maghribi style, is for 28 stars. There are six plates, with the names of places as well as the latitudes in which they could be used, and the interior of the mater is also engraved as a plate, whereas on some western astrolabes the mater bears a perpetual calendar.[6]

The Judaeo-Arabic astrolabe, cat.124, is in the same stylistic tradition. As mentioned above, there were scarcely any astrolabe makers in North Africa before the expulsion of the 'Moors' from Spain. A maker who worked in North Africa before 1492 is Abu Bakr ibn Yusuf of Marrakesh, known as the maker of particularly fine astrolabes, dating from AH603 (AD 1206–7) to AH 615 (AD 1218–19), though of these five two may be the same instrument.[7]

One of the last known astrolabe-makers in Spain before the expulsion of the 'Moors' was the famous astronomer, Abu Ja'far Ahmad ibn Husayn ibn Baso, who died in AH 709 (AD 1309–10), and who had been the *muwaqqit* of the Great Mosque of Granada, when the kingdom of Granada flourished under Nasrids; his work is reputed to have surpassed that of the *andalūsī* makers of the past.[8] Over a hundred years later, and nearer the time of the expulsions, there was still an astrolabist working in Granada, Muhammad ibn Faraj, who was active in about AD 1475. The revival of Western Islamic astrolabe-making in North Africa, after the expulsion, includes the sole known work of 'Ali ibn Muhammad ibn 'Abdallah ibn Faraj, dated AD1504–5, and who was possibly related to Muhammad ibn Faraj; and the brothers, Abu'l-Hasan 'Ali and Abu 'Abdallah Muhammad, sons of Muhammad al-Azdi (AD 1543–4). In the 17th century, there is 'Abdallah ibn Sasi, of Safi, who made an astrolabe in 1687–8 and the al-Hasan ibn Ahmad al-Battuti, whose younger brother, Muhammad ibn Ahmad al-Battuti, was a prolific maker at Meknès, apparently dominating astrolabe-production in early 18th-century Morocco.[9]

1. See Brieux & Maddison, forthcoming, 'Muḥammad b. aṣ-Ṣaffar'.
2. Al-Andalusi, p.65.
3. See above, cat.125.
4. Quoted from al-Andalusi, p.69.
5. Brieux & Maddison, forthcoming, 'Ibrahim b. Sā'id'. The celestial globe (Ibrahim b. Sa'id 4) was made by Ibrahim with his son, Muhammad, and is dated at the 'beginning' of Safar 478 (May 1085). It is the earliest Islamic celestial globe known, and is now in the Istituto e Museo di Storia della Scienza, Florence.
6. This astrolabe is in the Museum of the History of Science, Oxford University, no.CCA118; Brieux & Maddison, forthcoming, 'Ibrahim b. Sā'id 2'. It is dated Shawwal 460 (August 1068).
7. Brieux & Maddison, forthcoming, 'Abū Bakr b. Yūsuf'.
8. Brieux & Maddison, forthcoming, 'Aḥmad b. Ḥusayn b. Bāṣo'; Renaud 1937; Drouot, 9–10 October 1980, notes to lot no.162 (illustrated).
9. On all the makers mentioned, see Brieux & Maddison, forthcoming, s.vv.; see also the description of cat.152, by Muhammad ibn Ahmad al-Battuti and the photographs of it illustrating the use of an astrolabe (pp. 203–5, above).

152

Planispheric astrolabe

Morocco, probably Meknès, dated AH 1118 (AD 1706–7)

Brass, sheet and cast, cut and engraved; the rete is set with silver studs, some now missing
diameter 20 cm
maximum height 23.5 cm (excluding shackle and suspension ring)
maximum thickness of mater 0.7 cm
maker Muhammad ibn Ahmad al-Battuti
accession no. SC130
provenance Edward Jones Collection, Los Angeles

The rete indicates 26 named stars; the bases of the curved star-pointers are embellished with silver studs, eight of which are missing while one was never inserted. Two similar studs, placed as turning aids on the horizontal crossbar, are also missing. The scale on the ecliptic circle is based on units of three degrees and numbered at intervals of six degrees. The limb of the mater bears a scale of 360°, which is numbered clockwise at intervals of five degrees, in the sequence /h/ = 5°, /y/ = 10°, /yh/ = 15°, /k/ = 20° to /mh/ = 345°, /sn/ = 350°, /nh/ = [3]55° and /ṣṣ/ = 360°. There are three plates. The first is engraved on both sides with almucantars at intervals of three degrees and azimuths at intervals of five degrees, in addition to the equator, the tropics and, in the lower half of the plate, lines for unequal hours. The data given on one side is 'for the latitude of Mecca (May God ennoble it!), 21° 40′' and, on the other side, 'for all the cities at a latitude of 32° 30′'. The second plate is similarly inscribed for cities at latitudes of 30° and 31° 30′, and the third for cities at a latitude of 33° 30′ on one side and on the other a tablet of horizons with no numeration except for the *abjad* numeral /w/ = 6, indicating that its lines were drawn at six-degree intervals. The *kursī* is blank. The alidade is of typical plain, straight Maghribi type; the pin and rosette-shaped washer may be original.

The inside of the mater is blank. On the back, the upper two quadrants of the limb are divided to each degree and numbered at intervals of five degrees from the east–west line to the top. There is a zodiac–calendar scale (0° Aries = 9 March), with an unequal-hour diagram and a shadow square within. Part of the horary diagram was effaced when an inscription that overlaid it was obliterated. On a semicircular band across the horary diagram (the diameter of the band corresponding to the intersection of the shadow square with the horizontal line) there is the signature of the maker, Muhammad ibn Ahmad al-Battuti and the date, expressed in *abjad* numerals as /sh f y ḥ/ = AH 1118 (AD 1706–7).

The *abjad* system employed here is that current in the western Islamic world, which varies from the standard system for some numbers above 50.

Muhammad ibn Ahmad al-Battuti is the best known of Maghribi astrolabists, 20 astrolabes and an astrolabe-quadrant by him having been recorded.[1] Cat.152 is the earliest, while the latest was made in AH 1151 (AD 1738–9). On an astrolabe he made in AH 1138 (AD 1725–6),[2] he signed himself as Muhammad ibn Ahmad ibn al-Hasan al-Battuti. His brother was al-Hasan ibn Ahmad al- Battuti, an astrolabist known from three instruments dated AH 1097 (AD 1685–6), 1103 (1691–2) and 1106 (1694–5).[3] On another astrolabe, made in AH 1148 (AD 1735–6) and now in a private collection in Paris, Muhammad ibn Ahmad al-Battuti described himself as working in Meknès 'of the olive-trees',[4] and cat.152 may have been produced in the same city.

1. Brieux & Maddison, forthcoming, 'Muḥammad b. Aḥmad al-Baṭṭūṭī 1'; Gibbs, Henderson & de Solla Price 1973, no.2706.
2. Brieux & Maddison, forthcoming, no.11.
3. Brieux & Maddison, forthcoming, 'al-Ḥāsan b. Aḥmad al-Baṭṭūṭī 1–3'.
4. Brieux & Maddison, forthcoming, 'Muḥammad b. Aḥmad al-Baṭṭūṭī 19'.

153

Planispheric astrolabe

Morocco, *circa* 1700

Brass, sheet and cast, cut and engraved; the rete is set with silver studs
diameter 21.1 cm
maximum height 24.5 cm (excluding shackle and suspensions ring)
maximum thickness of mater 0.7 cm
accession no. SC150

This finely made astrolabe dates from the late 17th or early 18th century, when most surviving astrolabes from Morocco were made by al-Hasan ibn Ahmad ibn al-Battuti, who worked in Meknès, by his brother, Muhammad ibn Ahmad ibn al-Hasan ibn al-Battuti, the maker of cat.152, or by Muhammad ibn Ahmad ibn Ibrahim, who worked in Fez.[1] This example is similar to cat.152 although it differs in such details as the pattern of tracery on the rete, the hatching of the intervals between the divisions of the shadow square and in the style of *maghribī* script, but Muhammad ibn Ahmad al-Battuti's work is never entirely consistent. Only seven of the 20 astrolabes known to be by him are engraved with a scale of lunar mansions correlating with the zodiac–calendar scale; only five have hatching between the shadow square divisions; and at least nine have a characteristic line across the digraph *lām-alif*.

All but two of the 27 star-pointers on the rete are set with silver studs at the base. There are three plates, engraved with almucantars at intervals of three degrees, with azimuths at intervals of ten degrees, with the equator and tropics, and lines for unequal hours. The inscriptions below the horizon lines indicate that these plates were made for the latitudes 30° and 32°, 33° and 35°, and 34° and 36°. The cities mentioned include Cairo, Sijilmasah, Marrakesh, Tripoli, Meknès and Tetouan. The limb of the mater is inscribed with a scale of 360°, numbered clockwise in the Maghribi form of *abjad* notation at intervals of five degrees (in the sequence 5–100°, 5–95°, 200°, 5–95°, 300°, 5–60°).

The inside of the mater is blank. The upper quadrants on the back bear two scales of 90°, with 0° on the horizontal east–west line. Within these there is a zodiac/Julian calendar scale (0° Aries = 9 March). This has an inner register showing the 28 lunar mansions, which are named; the correlation is unusual on a Maghribi astrolabe.[2] The central zone is occupied by a diagram of unequal hours and a shadow square. The *kursī* is plain and of medium height, and the shackle and suspension ring appear to be original, as do the straight alidade, the pin and the horse.

1. Brieux & Maddison, forthcoming, 'al-Ḥasan b. Aḥmad al-Baṭṭūṭī', 'Muḥammad b. Aḥmad al-Baṭṭūṭī' and 'Muḥammad ibn Aḥmad ibn Ibrāhīm'.
2. A convenient account of the lunar mansions is given in Savage-Smith & Smith 1980.

154

Planispheric astrolabe

The Maghrib, probably Morocco, perhaps 18th century

Brass, sheet and cast, cut and engraved; the rete is set with silver studs, some now missing
diameter 11.5 cm
maximum height 13.2 cm (excluding shackle and suspension ring)
maximum thickness of mater 0.6 cm
accession no. SC127

The rete indicates 21 stars. The bases of most of the star-pointers are embellished with single silver studs, and one star pointer (*Baṭn Qīṭūs* = ρ/σ/ε/π *Ceti*) has three such studs; there are two similar but larger studs on the horizontal crossbar of the tracery, to serve as 'turning knobs' (*mudīr*). Each sign of the ecliptic circle is divided only to six degrees. The limb is divided to each degree and the scale is numbered clockwise at intervals of five degrees, using the Maghribi form of *abjad* notation (in the sequence 5–100°, 5–95°, 200°, 5–95°, 300°, 5–60°). The four plates are engraved on both sides with almucantars at intervals of six degrees and azimuths at intervals of 15 degrees, in addition to the equator, tropics and hour-lines. However, the hour-lines did not originally include the barbed prayer-time lines usually found on Maghribi astrolabe plates (compare cat. 152 and 153). These have been added in a rather coarse manner on the plate made 'for the latitude of the city of Fez (33° 40′)' and 'for the latitude of the city of Meknès (34°)'. The other plates were made for use in Jerusalem (32°) or Tetouan (35°); in Tunis (36°) or any city at latitude 28°; and in Marrakesh (31° 30′) or Cairo (30° 50′). The inside of the mater is blank.

On the back, within two quadrant scales of 90°, are a zodiac–calendar scale (0° Aries = 9.5 March), an unequal-hour diagram, and a shadow square. The *kursī* and suspension apparatus are fairly characteristic of Maghribi astrolabes, as is the 'straight' alidade with typical Maghribi notched decoration along part of its bevelled edge; there is a subtly-designed horse, a simple rectangle with a small parallel projection which locks it in place.

The absence of prayer-time lines, the absence of Mecca and the presence of Jerusalem might suggest that this astrolabe was made for a non-Muslim in Morocco, perhaps a Jew, and later adapted for Muslim use in Fez or Meknès.

154, front of mater, plates and rete

154, back of mater with alidade

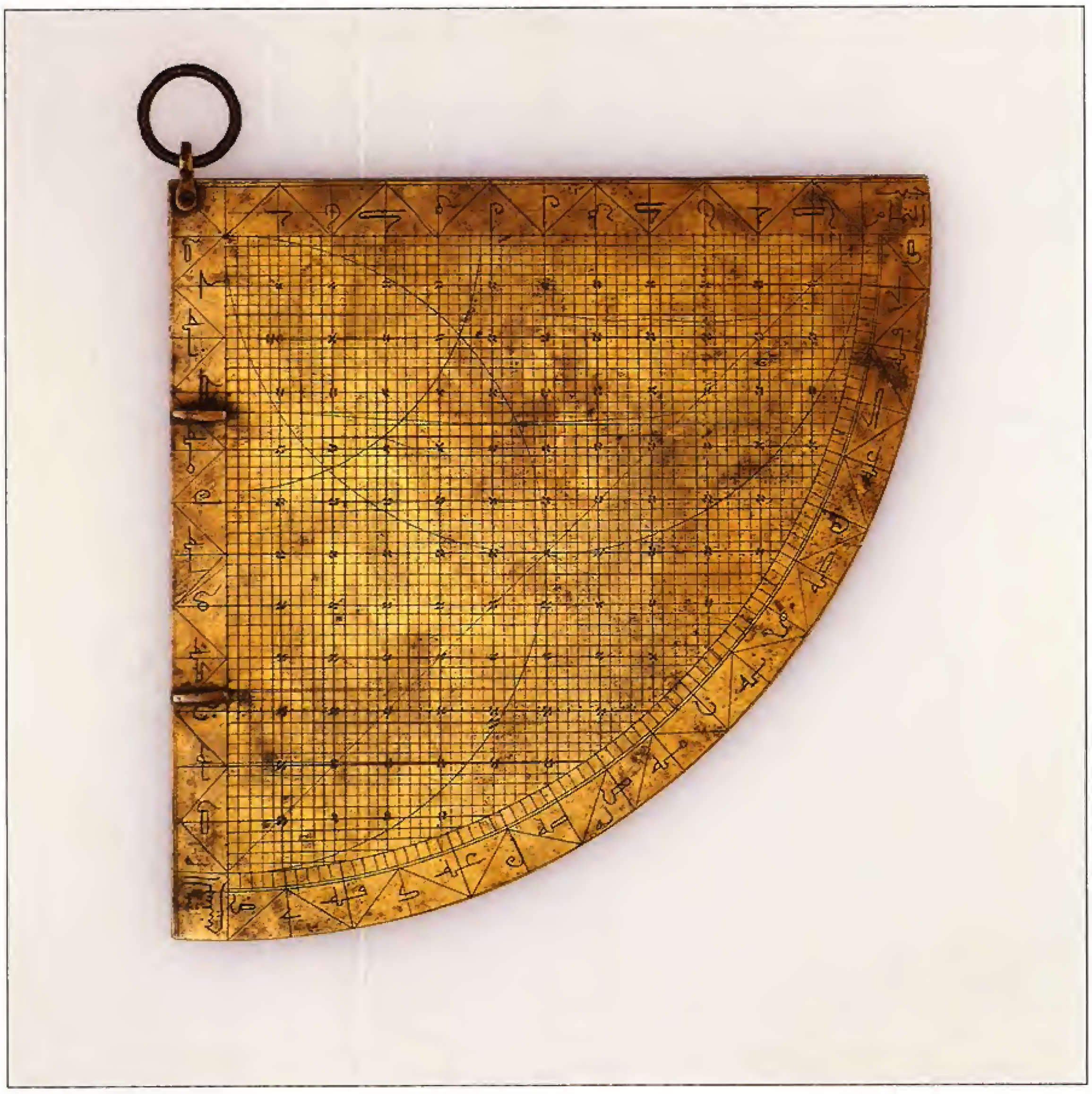
155

Sine–cosine quadrant

Morocco, dated AH 1344 (AD 1925–6)

Brass sheet, engraved
outer radii 15.5 and 15.6 cm
accession no. SCI41

This instrument is engraved as a sexagesimal sine–cosine quadrant, with arcs of sine and versed sine. The reverse is blank except for an applied disc with a scalloped edge engraved, 'Year 1344. In the time of the *amīr* Ahmad ibn Abi Bakr al-Zanati. Fez'. The amir referred to is presumably one of the Zenata berbers.



155

Quadrants[1]

The name 'quadrant' is given to several types of instrument which consist essentially of a flat plate, of wood or metal, in the shape of a quarter of a circle. The simplest form of quadrant has a scale of 90° along the curved edge, and a plumb-line and bob suspended from the apex of the right-angle. Equipped with a pair of sights, it can be used for measuring the angular elevation of a heavenly body, or in surveying. Simple quadrants were used in Hellenistic times, and this primitive form was developed in early Islam on the basis of trigonometrical knowledge, partly derived from Indian sources. The radii were divided sexagesimally, and crossed parallel lines were drawn from the divisions to the scale of 90°, to create a nomograph of sines and cosines of the angles marked on the arc; horizontal lines for the sines, vertical lines for the cosines. The quadrants usually also had certain additional lines, such as 'the arc of the obliquity of the ecliptic' and arcs of sines and 'versed sines'. This type of quadrant is called a sinecal, or sine, or sine – cosine quadrant (*rubʿ al-mujayyab*) or quadrant of the canon (*rubʿ al-dastūr*). It was developed in Baghdad in the 9th century, and is often found in the upper-left quadrant on the backs of astrolabes. It has been described as 'a kind of medieval astronomer's slide-rule. With such a device, bearing markings resembling modern graph-paper, ... one can solve numerically the most complicated problems of medieval trigonometry, such as ... the qibla problem',[2] and time-telling. On an astrolabe, the alidade was used, but on a separate quadrant, there was a plumb-line, of cotton or string, with a brass or lead weight, and with a sliding bead, as described below. Another type of quadrant (horary quadrant) was engraved with a diagram of unequal hours for a particular latitude and a zodiac scale (that is, of solar declination) above a scale of degrees, and was used with a plumb-line with sliding bead.

Two very small quadrants (with a radius of approximately 60 millimetres) of this latter type are known.[3] They are engraved in Kufic script and are difficult to date, and dates from the 10th to the 13th centuries of our era can be suggested; one is signed by Muhammad ibn Mahmud,[4] the other by Saʿdu ibn ʿAli al-Muʾadhdhin (i.e. the muezzin), both from eastern Islam. The former is now in the Metropolitan Museum of Art, New York;[5] the latter was stolen from a private collection in Kuwait. Both are engraved on one side only. Along the arc, there is a scale of degrees. Equidistant concentric arcs of the signs of the zodiac are engraved above. Over the arcs are plotted lines for unequal hours. In use, a plumb-line (with a sliding bead on the string) and bob were suspended from the apex. The plumb-line was held taut along whichever zodiac scale, along one of the radii (there are six of the signs named along each radius), included in the zodiacal sign in which the Sun was known to be on the day of use. The bead was then moved along the plumb-line until it lay in a position, in the sign, roughly corresponding to the Sun's declination (e.g. if the Sun were known to be at 10° Leo, then the bead would be moved until it was a third of the way along from the beginning of Leo, towards the beginning of the next sign). Then the plumb-line was allowed to hang freely, and the quadrant directed towards the Sun, so that light falling through the pin-hole in the fore-sight fell centrally on the back-sight (both sights are on one of the radii). The position of the bead in relation to the hour-lines then indicated the time. This type of horary quadrant could be made usable in any latitude by engraving the zodiac scale on a sliding cursor, but no Islamic examples of this universal type are known.

Yet another type of quadrant derives from the astrolabe and will fulfill many of the functions of that instrument. Though its use is more complicated than that of the astrolabe, it is more simple to make and cheaper. The astrolabe quadrant, as it is generally called, was described by the Judaeo-Provençal mathematician, astronomer, and zoologist, Yaʿaqob ben Mahir ibn Tibbon of Marseilles and Montpellier, known in Latin as Prophatius Judaeus and in Romance as Profeit Tibbon (*circa* AD 1236–*circa* 1304). He called his quadrant *robaʿ Yisrael* and it was also known as *quadrans novus* to distinguish it from earlier quadrants. It is an ingenious reduction to a quarter of a circle of the essential lines of the stereographic projection on the rete and plates of a conventional astrolabe (hence its Arabic name: *rubʿ al-muqantarāt*), achieved by 'folding' twice, each time on to the other half, the astrolabe projection. As Michel summarized it, '... Prophatius' instrument no longer resolves problems of spherical astronomy by a purely geometric procedure [as on a conventional astrolabe], but by a combination of geometry with trigonometry. In that respect there is a notable evolution of its mathematical method. The [astrolabe] quadrant is at the same time both an observational instrument and a true "slide-rule".'[6]

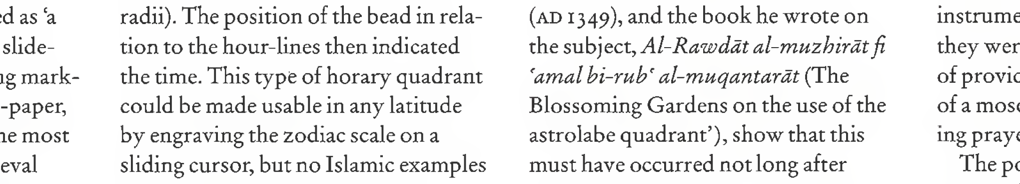
The typical Islamic quadrant is engraved or drawn on one side as a sine–cosine quadrant and on the other side as a Prophatius astrolabe quadrant. Such quadrants were made and used in Islamic countries until at least the first decade of this century; there are examples from the Maghrib in the 19th century and from the Ottoman Balkans in the early 20th century. The mode of transmission of the Prophatius astrolabe quadrant from medieval Europe to Islam is not known, but astrolabe quadrants of AH 727 (AD 1326–7) and subsequent years, made by Muhammad ibn Ahmad al-Mizzi, who died early in AH 750 (AD 1349), and the book he wrote on the subject, *Al-Rawdāt al-muzhirāt fi ʿamal bi-rubʿ al-muqantarāt* (The Blossoming Gardens on the use of the astrolabe quadrant'), show that this must have occurred not long after Prophatius wrote his own treatise, unless there be an as yet undiscovered common source.

Astrolabe quadrants, now in the British Museum, London,[7] and the Museum of Islamic Art, Cairo,[8] were made in AH 727 (AD 1326–7) by al-Mizzi, almost certainly in Damascus, perhaps less then 60 years after Prophatius wrote his treatise. They are of brass, finely engraved in Kufic script, and were made for latitude 33° 30′ (Damascus); 21 stars are marked on that in the British Museum. Three other quadrants (but no astrolabes) made by al-Mizzi are known.[9] His quadrants sold for two dinars and more, his astrolabes for ten dinars during his lifetime, and for double that after his death. Also in the British Museum is an astrolabe quadrant, made in AH 735 (AD 1334–5) for the chief muezzin of the Umayyad Mosque in Damascus, by ʿAli ibn al-Shihab, and engraved by Muhammad ibn al-Ghazuli.[10] Mostly engraved in Kufic script, with a long inscription damascened in silver, it is quite large, having a radius of 200 millimetres. Twelve stars are marked, and it was made for latitude 30° 27′ (Damascus). Another early astrolabe quadrant is that made, unusually, of ivory by Abu'l-Tahir, now in the Benaki Museum, Athens.[11]

From the late 17th century, a characteristic form of astrolabe quadrant became, to judge by the number which survive, very popular in the Ottoman Turkish empire. They are drawn in ink on painted wood, often with gold and coloured lacquer decoration. Above the astrolabe quadrant proper, there is usually a small horary diagram (a horary quadrant as described above) constituting a sundial for unequal hours; the other side is the usual quadrant. One radius of the instrument has two raised sections, to serve as fore-sight and back-sight, and sometimes long inscriptions on the edges (which are thick, because the quadrants are of wood) or elsewhere give instructions for use. It may be surmised that these instruments were popular because they were a cheap and convenient way of providing the *muwaqqit* or muezzin of a mosque with a means of determining prayer times.

The portable astronomical instruments which have been discussed here and elsewhere in this volume, the globes, astrolabes, the sundials, and the qiblah-indicators represent part of a tradition of precision technology in Islam, from the 8th to the 20th century (and independent of the impact of European 'world' science and technology from the late 17th century onwards, especially in the Ottoman Empire).

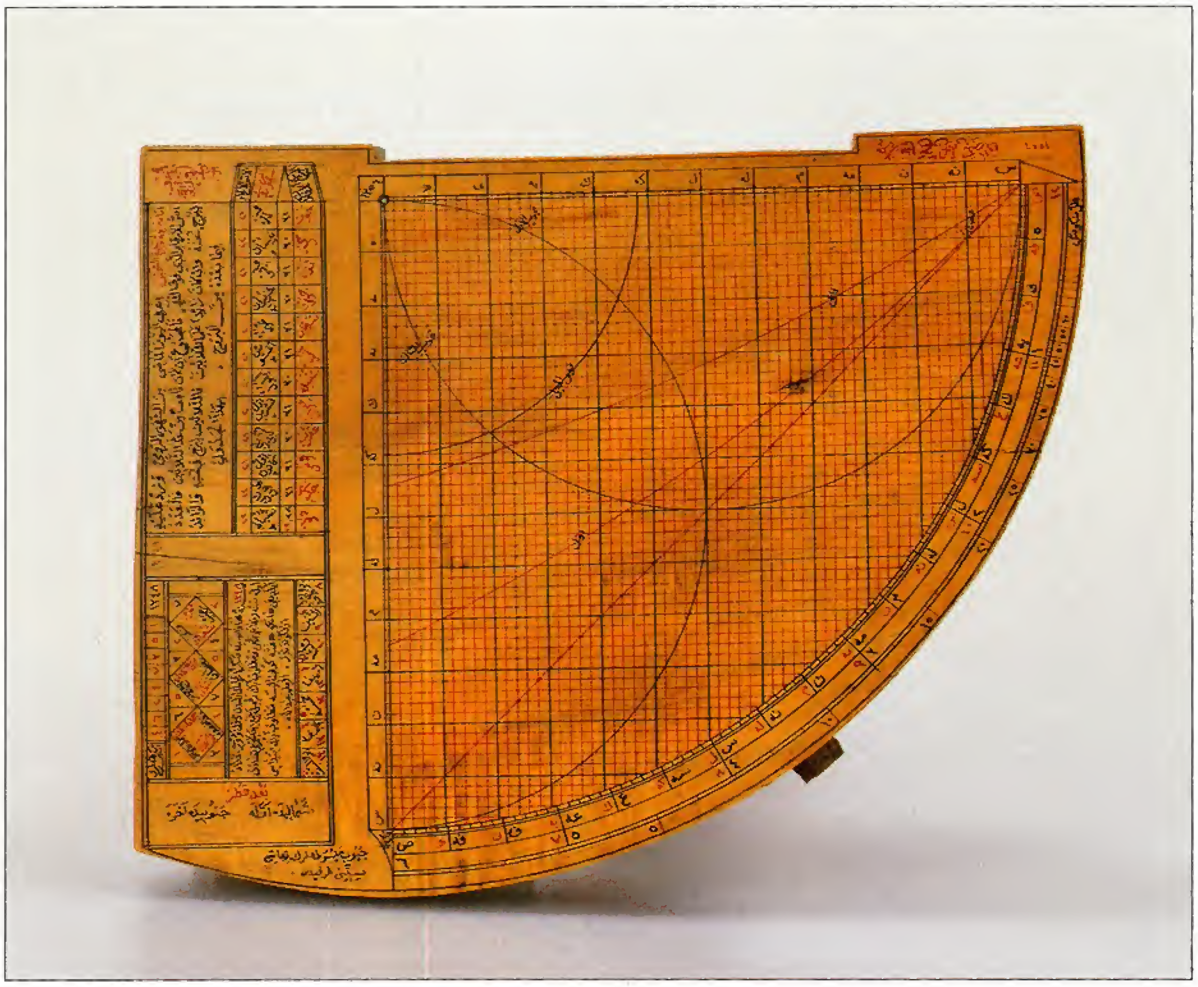
These are the types of instrument which are to be found today in museums and private collections. It may be assumed that these instruments represent the currency of small devices used by practitioners of various scientific or partly-scientific crafts. Inevitably, this implies omissions. There may have been, in some region or period, devices which have



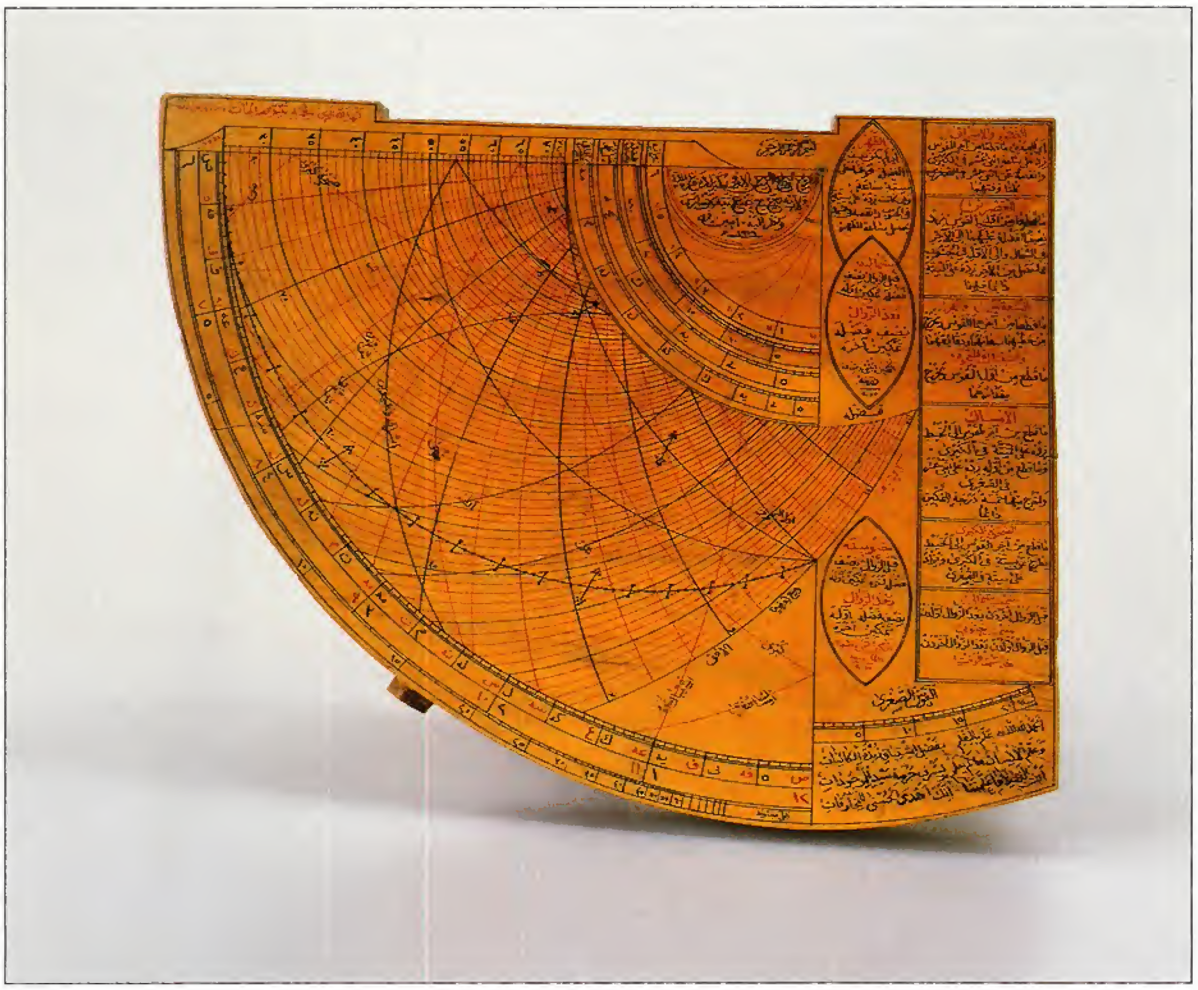
156, detail of radial edge with instructions for use

almost entirely disappeared, because they were uncommon, because they were fragile, or because they did not continue to be prized.

1. The basis of this text was originally written by Francis Maddison for an encyclopedia of Islamic science (Rashed 1996), but omitted through a misunderstanding; it should appear in the French and Arabic versions of the encyclopedia. On quadrants in general, including astrolabe quadrants, see Turner 1985 pp.202ff., and on Islamic quadrants, Schmalzl 1929 and King 1987, no.1, pp.6–10.
2. King 1987, p.9
3. On these quadrants, see Brieux & Maddison, forthcoming, s.vv, and Maddison & Turner 1976, p.151, nos 70 and 75.
4. Probably the maker of the globe discussed above, cat.121, the son of Mahmud ibn 'Ali al-Tabari; the globe may be dated *circa* AD 1285.
5. Inv. no.36.20.54
6. Translated from Michel 1947, p.128; see also Saunders 1984, pp.48–53, for the technical description.
7. Inv. no.o. 95.11.-16.1; see Brieux & Maddison, forthcoming, 'Muhammad b. Ahmad al-Mizzi 2', and Maddison & Turner 1976 p. 52, no.73.
8. Inv. no. 3092; Brieux & Maddison, forthcoming, 'Ahmad b. al-Mizzi 1'.
9. Brieux & Maddison, forthcoming, 'Ahmad b. al-Mizzi', 3, 4, & 5, respectively in the David Collection, Copenhagen (AH 730), Muzeĭ M.V. Lomonosova, St Petersburg (AH 734), and the British Museum, London (AH 734), inv.no.88, 12, 1276; see also the biographical note on this maker.
10. Inv.no.62,12.27.1; Brieux & Maddison, forthcoming, ''Ali b. ash-Shibab'; Maddison & Turner 1976, pp.153, 154, no.75, from the collection of William Hook Morley (1815–60), where the remarkable illustrations in Morley's book on this astrolabe quadrant, and in Morley 1856 are discussed.
11. Inv.no.10698. See Brieux & Maddison, forthcoming, 'Abu-l-Tahir'; Maddison & Turner 1976, p.153, no. 75; Mayer (1956) gives the date as AH 749, but though the quadrant is engraved in Kufic script, the date is written not in *abjad* but in Hindu-Arabic numerals, and is not clear: it might be AH 740, 741 or 749.



156, side (A)



156, side (B)

156

Astrolabe quadrant

Istanbul, dated AH 1256 (AD 1840–41)

Wood, with lines and scales and texts in vocalized *naskh* in black and red, lacquered
outer radii 12.8 cm and 16.8 cm
depth 3 cm
maker al-Hafiz al-Hasan al-'Ufi (Hafiz Hasan al-Hilmi), known as Gebirzade (?)
accession no. SCI40
published Geneva 1995, no.67

On one side of this instrument is a Prophatius astrolabe quadrant for latitude 41°, with an unequal-hour diagram above (A). On the other side there is a sine–cosine quadrant with arcs of sine and versed sine (B). The longer radius is indented so as to provide two sight vanes. Both sides and one edge are inscribed with tables and instructions.

The quadrant is signed and dated at the end of the degree scale on the limb of the astrolabe quadrant and at the apex of the sine–cosine quadrant.

The names used by this maker vary slightly, but he appears to have been a Turk from the town of Of in Pontus (*al-Ufi*) called Hafiz Hasan Hilmi, and his family name may be read as Gebirzade ('son of the infidel'). This reading is supported by the fact that Of was part of the Greek empire of Trebizond until 1463, after which its population gradually converted to Islam, a process that was not complete by the Turkish War of Independence and the exchange of populations.

157

Quadrant

Turkey, dated 6 Ramadan 1303 (29 May 1886)

Thin boards glued to a wooden core, inscribed in red and black, lacquered; edges painted with red lead; brass bushes for plumb lines
outer radii 15.8 cm and 13.6
depth 2.2 cm
radius of inscribed quadrant 12.3 cm
maker al-Hajj Sayyid Sulayman Rushdi [?] Sukudi
accession no. SCI162
published Geneva 1995, no.68

On one side there is a sine–cosine quadrant, with the scale of degrees along the limb set out decoratively. To the left of the quadrant there are instructions for use in Turkish, with a table including the Turkish names of the solar months. On the other side are astronomical tables, a scale of 90° along the limb, and a cartouche containing the signature of the maker, el-Hac Seyyid Süleyman Rüşdi [?] of Söğüt. His home town may be identified with a small settlement in north-western Anatolia, to the north-west of Eskişehir. The quadrant is also signed 'Söğüdi' on the fore-sight.

158

Astrolabe quadrant

Turkey, *circa* 1800

Wood, lines in black ink and inscriptions in *riqa'* script, gilt dots on scales, lacquered; brass bushes for plumb lines
outer radii 9.9 cm and 10 cm
depth 1.3 cm
maker 'Uthman Busnawi
accession no. SCI48
published Geneva 1995, no.69

This instrument is unusual in that it does not carry the full range of diagrams typical of such astrolabe quadrants: it lacks a sexagesimal sine–cosine quadrant on one side, and there is only a basic array of lines, with many common details, such as almucantars (circles of altitude), omitted. The main divisions of the scales are highlighted by gilt dots, and the sparse numeration occurs only on the hour scales, which are numbered in Hindu-Arabic numerals.

On one side (A), in addition to the stereographic projection of the ecliptic, there are scales including hour-scales, which have two different centres to permit the use of two plumb-lines simultaneously. The brass grommets for the plumb-lines pass through to the other side (B). The instrument carrries instructions for calculating the almucantar, and the sine of the rising star.

As is customary, one radius is cut so as to provide a raised part at each end to serve as sight vanes. Below the 'vane' nearest the apex on side (A) is the maker's signature, 'Uthman Busnawi, *i.e.* Osman of Bosnia, where astrolabe-quadrants continued to be made until after the end of the first decade of the 20th century. This is perhaps the same maker as the one who signed, 'Drawn by Osman', on an astrolabe quadrant dated AH 1211 (AD 1796–7), in a private collection in Sarajevo.[1]

1. Brieux & Maddison, forthcoming, ''Uthmān'. An astrolabe quadrant dated AH 1096 (AD 1684–5) and signed Sayyid 'Uthman is now in the Egyptian National Library, Cairo.

158 side (A)

159

Astrolabe quadrant

Istanbul, dated AH 1279 (AD 1862–3)

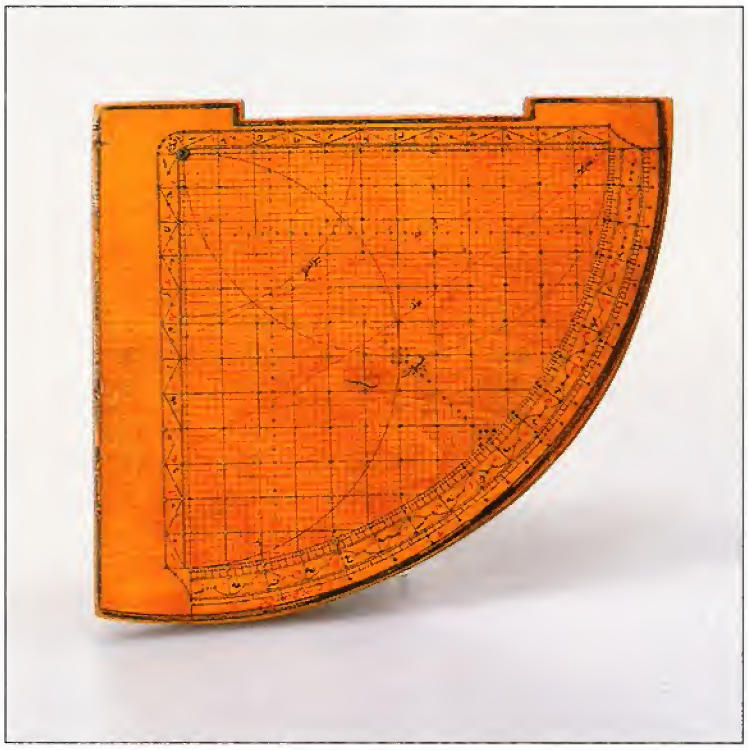
Wood, with lines, scales and occasional captions in black and red ink, ornamented with gold, lacquered
outer radii 10.1 cm and 12.5 cm
depth 1.3 cm
maker Ibrahim Nesimi
accession no. SCI120
published Geneva 1995, no.66

This typical Turkish astrolabe quadrant is drawn on one side (A) with an astrolabe-quadrant projection and an unequal-hour diagram for latitude 41° (sc. Istanbul); and on the other with a sine–cosine quadrant (B). The plumb line (with sliding bead) and bob, now missing, were suspended from the brass grommet at the apex of the unequal-hour diagram, above the maker's singature, 'Drawn by İbrahim Nesimi'. The date appears in the triangular space below the 'back sight', at the end of the degree scale on the arc.

The form of the latitude inscription below the astrolabe-projection is worthy of note. The word *li-'arḍihi* ('for its latitude'), in black, is followed by the letters /m/ and /'/ in red, with a line drawn above them to indicate that the letters are to be read as *abjad* numerals. There follows a zero symbol, for the minutes, derived from the ꝿ found in Greek manuscripts (see above, p.187).

157

159, side (A)



159, side (B)

160

Astrolabe quadrant

Ottoman empire, 10 Jumada II 1297 (20 May 1880)

Brass sheet, engraved
radius 14 cm *height* 0.7 cm
maker 'Abd al-Muhsin ibn al-marhum Salih Efendi al-Muradi
accessio no. SC132

One side is engraved with an astrolabe quadrant for latitude 33° 30′, and on one radius there are two pin-hole sight vanes. The maker's signature occupies the space between the outer scale of the astrolabe quadrant and the edge of the quadrant plate. The back is engraved as a sine–cosine quadrant. The plumb-line and bob are missing.

161

Graphometer

Turkey, *circa* 1900

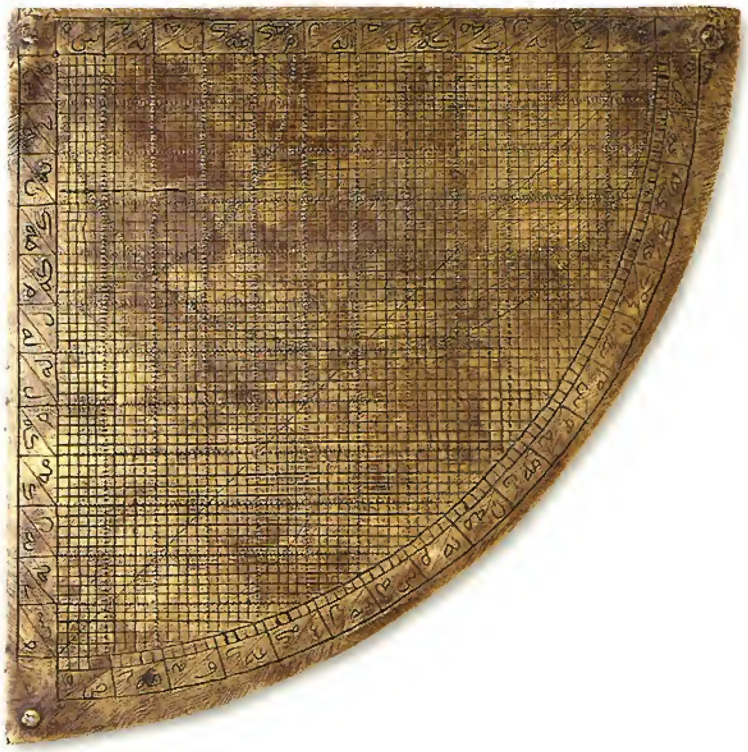
Brass, engraved, with pivot, alidade and shaft of steel; two brass washers, one flat and one with a recessed top and milled sides; alidade has brass tips
diameter of circle 24.7 cm
diameter of pivot 1.1 cm
height of pivot 0.6 cm
length of alidade 22.3 cm
height of shaft 1.1 cm
maker Imperial Cannon Foundry, Istanbul
accession no. SC1130

The *graphomètre* was invented by the 16th-century French printer, type-designer and instrument-maker Philippe Danfrie (d. 1606), who was appointed *Graveur général des monnaies de France* in 1582.[1] It is the reduction to a semi-circle of an older European surveying instrument, the circumferentor, which was based on a full circle. Both instruments were used for measuring horizontal angles in the field, supported on a pole stuck in the ground or on a tripod.[2] This example bears the legend, *Top Fabrikası nümero 207* ('Cannon Foundry, no. 207'), engraved on the diametral bar and was probably made by the Imperial Cannon Foundry in Istanbul for the Ottoman army. The number 112, and the letter S appear on the underside of the bar.

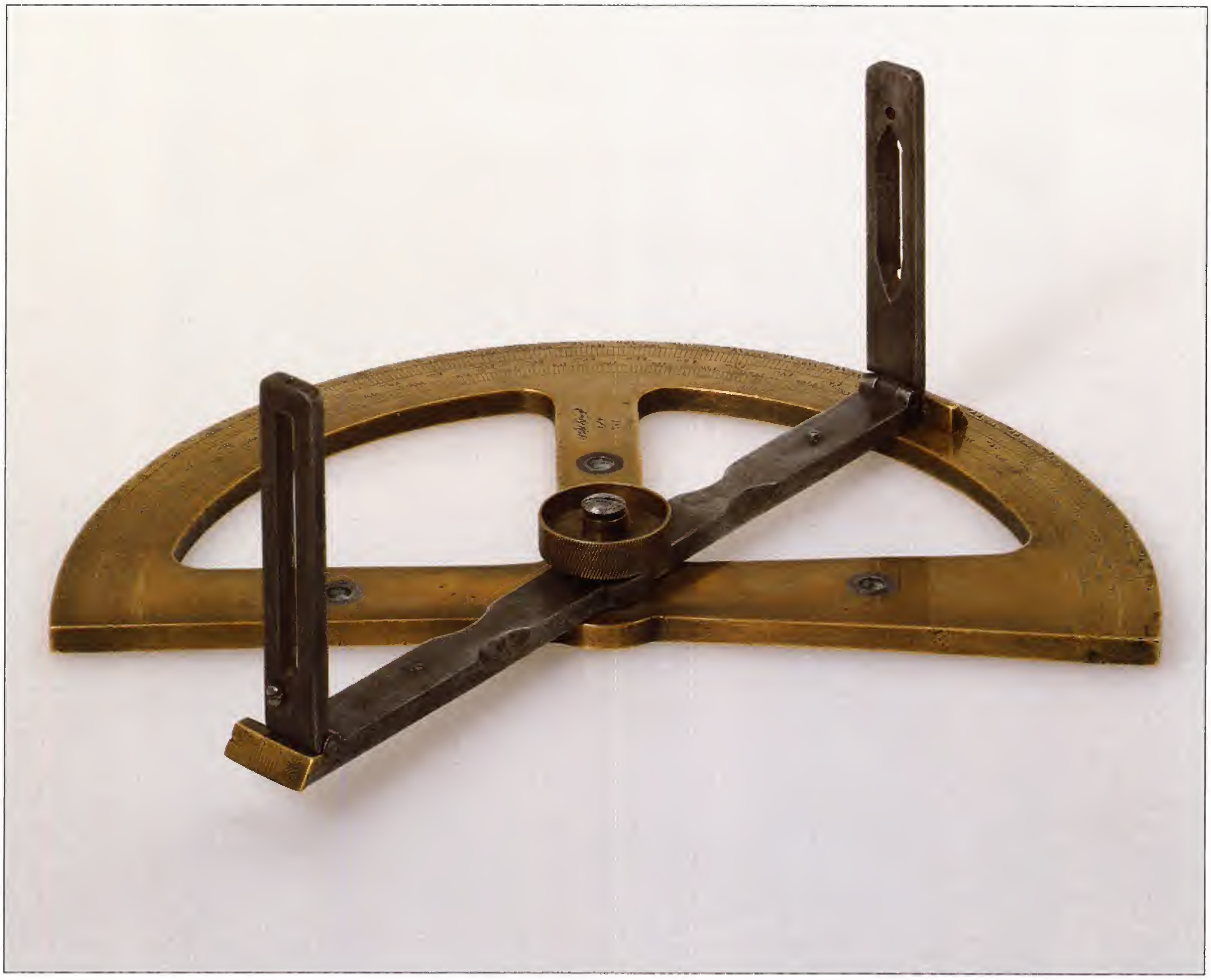
The circumferential scales are divided to each degree and numbered in both directions. An alidade, pivoted at the centre, is equipped with two folding sights.

1. Danfrie 1597; on Danfrie, see Carter & Vervliet 1966; Turner 1989, esp. pp. 29–30, and 36, fig. 2.
2. On the circumferentor, see Kiely 1947; Maddison 1957, pp. 82–3, nos 253, 255, pl. XXXV.

160, side (A)



160, side (B)



161

Finding the direction of Mecca[1]

The setting of the qiblah, the direction the worshipper must face during prayer, was one of the most important stages in the emergence of Islam as an independent monotheistic religion. When Muhammad instituted the *ṣalāt*, the obligatory prayers said at five set times during the day, he appointed Jerusalem as the direction of prayer, in accordance with the practice of Jews and Christians. But the failure of other monotheists, particularly the Jews of Yathrib (Medina), to recognize his mission led to a new emphasis on the Arab character of Islam. As a result the Ka'bah in Mecca was made the direction of prayer, in accordance with the revelation in the surah *al-Baqarah* (II, verse 144): 'We see the turning of thy face (for guidance) to the heavens: now shall We turn thee to a Qibla that shall please thee. Turn then thy face in the direction of the sacred Mosque: wherever ye are, turn your faces in that direction.'[2] This change created a new sacred geography with Mecca at its centre and presented every Muslim with the need to establish the bearing of the Ka'bah from his location at the hour of prayer. Upon moving from one place to another the bearing had to be ascertained anew, as when the great polymath al-Biruni (973–1048) was taken from Gurgan to Ghaznah by Sultan Mahmud in 1017, 'My particular purpose is, however, to determine these data, longitude, latitude, distance, and direction from the city of Ghazna, the capital of the Kingdom of the East, because, as a newcomer, I would like to consider it, by human reckoning, my homeland; though all true reckoning, in reality, is made by God only. In Ghazna, as long as I am able to do so, I shall persevere in carrying on the observations and the scientific research which is constantly in my mind, namely, the determination of the true direction of the *qibla*. This is not a personal matter, it concerns the people of Ghazna, as well as myself, and everyone staying temporarily in the city.'[3]

The crucial measurement sought by al-Biruni was the *inḥirāf al-qiblah*, the azimuth of the qiblah. This can be stated as a geographical problem, but in the medieval Muslim world it was treated as an astronomical one, that is, as the angle at the zenith of a given place between the great circle of the meridian of that place and another such circle passing through the zenith of the place and the zenith of Mecca.[4] Determination of this angle depends upon accurate knowledge of the geographical longitudes and latitudes both of the place from which the direction is required and of Mecca; the angle may then be calculated by methods using spherical trigonometry, orthographic projections of the sphere, or methods of approximation.[5] The determination of latitude did not present problems to Muslim astronomers, as passable results could be obtained by skilful use of an astrolabe, or by using one of the larger observatory instruments. On the other hand, the only reliable method of establishing longitude was by the observation of lunar eclipses, that is, by accurately recording the time of the eclipse at one place, and then comparing it with the time when the eclipse was observed at another place. As al-Biruni remarked, 'if we know beforehand of the formation of a lunar eclipse and we wish to determine the longitudinal difference between the two towns, we make arrangements beforehand for someone in each town who can measure the times accurately by instruments, to obtain as accurately as possible the times of the beginning of the eclipse and its end, and those of the beginning of clearance and its end.'[6]

The literature on the determination of the qiblah is extensive:[7] it appears that the compass in the astronomical compendium *Ṣandūq al-yawāqīt* ('The Chest of rubies') made in AH 767 (AD 1365–6) by Ibn al-Shatir is the first known example with a pivoted needle, and of a qiblah-compass.[8] Al-Biruni had described four trigonometrical methods, giving proofs, but declared that, 'These methods are sufficient for those who wish to use elaborate methods, but as architects and artisans can not work out the precise amounts which we have derived, they may proceed as follows ...'. He then proposed a straightforward geometrical construction for a line which 'gives the direction of prayer, and the base of the *mihrab* (prayer-niche) wall which is perpendicular to it', for use at Ghaznah. The construction, to be drawn 'on a polished stable surface', required knowledge of the direction of the meridian; he goes on to describe a method with a simple gnomon.[9]

Shams al-Din Muhammad al-Khalili, a contemporary of the astronomer Ibn al-Shatir (1306–75), and like him associated with the Umayyad Mosque in Damascus as a timekeeper (*muwaqqit*), computed a table of 2,880 entries in the usual sexagesimal notation that gives the azimuth of the qiblah as a function of longitude and latitude. The user of the table was therefore able to ascertain the direction of Mecca from places situated within a wide range of latitude and longitude coordinates.[10] The sine–cosine graph (*al-rub' al-mujayyab*) commonly found on Islamic quadrants, and also engraved on the back of many astrolabes, could be used for the computation of the azimuth of the qiblah. Graphs plotted on the arcs of the signs of the zodiac were commonly placed in the upper right-hand quadrant on the back of Iranian astrolabes from the Safavid period onwards (see cat.144; 146–50). They give the azimuth of the qiblah for a few selected towns, by indicating for any time of the year the altitude of the Sun (after noon) as it crossed the circle passing through the zeniths of the place of observation and of Mecca. In use, the graph appropriate to the place of observation was selected, and the alidade turned until it crossed the intersection of the line of the graph and the position, on the arcs of the signs, corresponding to the Sun's position in the ecliptic on the day of observation. This done, the end of the alidade showed, on the scale of degrees on the limb, the altitude of the Sun when it indicated the azimuth of the qiblah. It was then only necessary to wait until the sun declined to the altitude indicated.[11]

The introduction of the magnetic compass from China made it possible to manufacture small instruments which, when correctly oriented by means of the pivoted needle, would show the azimuth of the qiblah from a number of places marked on the compass plate. There is an account, written in the 13th century by the Egyptian Baylak al-Qibjaqi, of the use of a magnetic needle during a voyage from the Lebanon to Alexandria, but this was a pivotless needle floated on water.[12] A few astrolabes have small compasses set in the back of the *kursī*, and such compasses on some of the astrolabes made by the Iranian maker Muhammad Mahdi in the mid-17th century have qiblah directions engraved around them, as on cat.144 above.

The gazetteers engraved in the *mater* of astrolabes often give the longitude and the latitude of a number of places, as well as the *inḥirāf* (*al-qiblah*) for each place, that is, the azimuth of the qiblah expressed in degrees of an arc measured from the meridian as an angle of magnitude less than 90°. This information is accompanied by the *jihah*, the direction of the qiblah (for example, south-west or south-east), so that the quarter to which the *inḥirāf* refers is known, and occasionally by the *masāfah*, or distance from Mecca.

It is very common for portable sundials to include qiblah information and, to some extent, a precise distinction between portable sundials and combined qiblah compasses-and-sundials cannot be made. In Ottoman Turkey a number of elaborate qiblah sundials and compasses were produced, including the relatively rare *dā'irat al-mu'addil*, of which there are two examples in the Khalili Collection, cat.168 and 169.[13] By the 19th century a characteristic form of small qiblah compass, ornately engraved with the azimuths from several towns, and often with simple meridian gnomons for showing noon, had become popular in Iran (cat.164–66). Similar compasses were noted by E.W. Lane during his stay in Egypt in the 1830s, 'The astrolabe and the quadrant are almost the only astronomical instruments used in Egypt. Telescopes are rarely seen here; and the magnetic needle is seldom employed, except to discover the direction of Mekkeh; for which purpose, convenient little compasses (called 'kibleeyehs'), showing the direction of the kibleh at various large towns in different countries, are constructed, mostly at Dimyát: many of these have a dial, which shews the time of noon, and also that of the 'asr, at different places and seasons.'[14]

Qiblah compasses are still produced today, in Sweden, for example. An American device combines a simple compass with an electronic calculator, and an accompanying booklet gives geographical coordinates of numerous places, so that the (astronomically defined) Muslim prayer times may be ascertained.

1. This brief account is based on an unpublished chapter, 'The Azimuth of the Qiblah', in Maddison & Turner 1976, folios 268r–274r.
2. See also verses 142, 143, 145, and especially 149 and 150, from this surah.
3. Al-Biruni–Ali, p.32. For this author's account of the change in the Muslim qiblah, see al-Biruni–Ali, p.176.
4. The zenith of a place is the point on the celestial sphere directly above it. The meridian is the great circle on the celestial sphere that links the zenith of the place, the nadir of the place (the point on the sphere directly beneath it), and the two celestial poles.
5. Poole (note 2 to his extracts from al-Maqrizi in Lane 1914, p.604) gives data on the variable directions indicated by the mihrab in early Egyptian mosques.
6. Al-Biruni–Ali, p.130.
7. King 1975; 1979; 1982; 1986b; 1987b; 1990; 1993; King & Hawkins 1982.
8. Maddison & Turner 1976, folios 159r–161r, no.83; Janin & King 1977.
9. Al-Biruni–Ali, pp.241–58; the quotations are from pp.255–56.
10. King (1975) refers to al-Khalili's table as 'the most sophisticated trigonometrical table known to me from the entire medieval period' (p.82).
11. See King & Lorch 1992, pp.202–3.
12. Maddison 1992a, pp.205–7.
13. King & Lorch 1992, pp.198–200, 202 for a qiblah map of *circa* 1700.
14. Lane 1914, p.223.

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Combined qiblah compass and sundial

Iran, 18th century

Brass sheet, 19.3 × 11.3 cm, engraved, with a brass compass case, rotating pointer and replacement gnomon
maker 'Abd al-A'immah
accession no. SCI2

The rectangular plate is divided into two equal sections. The upper (southern) half was set with a small compass for orienting the plate, but only the case survives. Above the compass there is a quadrant scale, with a pivoted pointer to show the direction of the qiblah from the location of the user, and to one side there was a pin gnomon and lines for Babylonian hours (that is, equal hours counted from sunrise). The gnomon is now missing and has been replaced by a folding 'bird'-shaped gnomon, inspired by the noon gnomons on small round qiblah compasses such as cat.164, and also by the 'bird' gnomons on 17th- and 18th-century French pocket sundials, such as those made in Paris by Michael Butterfield (d.1724). To the right, there is a table of qiblah coordinates. The lower half of the plate is engraved with a series of equally spaced concentric arcs, numbered from 1 to 40, perhaps for use as a solar declination scale.

The underside of the plate bears two tables of geographical coordinates for various places and the maker's signature (lower centre), 'The most humble 'Abd al-A'immah made it'. Another qiblah indicator of this type signed by 'Abd al-A'immah, and also undated, is in a private collection in Paris;[1] its quality of workmanship is nearer that expected of the famous astrolabist, which may indicate that cat.162 is a copy. A third example, which is neither signed nor dated, but is finely engraved, is in the Museum of the History of Science, Oxford University.[2]

1. Brieux & Maddison, forthcoming, ''Abd al-A'imma 26'.
2. Inv.no.03.

163

Combined qiblah compass and sundial

Iran, 19th century

Brass sheet, 9.5 × 6.5 cm, with a small pegged foot, 0.9 cm high, at each corner, the top engraved and set with a modern replacement compass, pin gnomon and pointer
maker Fath 'Ali
accession no. SCI28

The top is engraved with a floral border set with four cartouches containing the names of the four cardinal points. The pin-gnomon sundial has lines for Babylonian hours, numbered in words, and for midday (*ẓuhr*), and the top left-hand corner is occupied by a quadrant of degrees with a rotatable pointer for setting the direction of the qiblah. Between the pin-gnomon sundial and the border a small compass has been set into the plate, and between the quadrant and the border the signature of the maker has been inscribed in Persian *nasta'līq* script in the form, 'Fath 'Ali made it', with a shaped cartouche.

The name of the maker and the manner in which it is written strongly suggest that this instrument was made in Qajar Iran.

164–166

Three qiblah compasses

Iran, late 19th or early 20th century

Brass sheet, engraved, with hinged lid and hasp; magnetic iron needle under a glass held in place by a pierced brass plate, to which a rotatable pointer and folding simple gnomon are attached
diameter 8.1 cm
height 1.6 cm, when closed
accession no. SCI37

Brass sheet, engraved, with hinged lid and hasp; magnetic iron needle under a glass held in place by a pierced brass plate, with a rotatable pointer attached,
diameter 6.5 cm
height 1.3 cm, when closed
accession no. SCI38

Brass sheet, engraved, with a hinged lid and hasp; magnetic iron needle under a glass held in place by a pierced brass plate, which was formerly furnished with a rotatable pointer; a brass suspension ring is attached to the hinge
diameter 3.1 cm
height 0.9 cm, when closed
accession no. SCI39

These three instruments are typical examples of the small qiblah compasses produced in Iran in the latter half of the 19th century and at the beginning of the 20th century. On cat.164 and 166 the lid, sides and base are covered inside and out with inscriptions giving the azimuth of the qiblah at many places, together with an indication of the *jihah*, the quadrant of the compass in which this angle occurs. On cat.165 this information is restricted to the exterior: the inside of the lid is blank, and the base of the compass box is engraved with lines showing the qiblah from the principal places of pilgrimage for Twelver Shi'is, namely, Mecca, Medina, Karbala', Najaf, al-Kazimayn, al-'Askariyyayn, Qum, Mashhad and Imam 'Abd al-'Azim near Tehran. The side of the lid of cat.164 and the side of the base of cat.165 also bear a quatrain giving instructions on the use of the compass.

On cat.164 and 165 the plate over the needle is engraved with a scale of degrees numbered by fives in *abjad* notation in four quadrants, while on cat.166 the scale is shown without this notation, due to the smaller size of the piece. In each case the plate had a rotating pointer pivoted at the centre, which served to set the direction of Mecca, and on cat.164 there is also a simple gnomon that shows noon when its shadow falls on itself, after the compass has been correctly oriented.

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166

164, open

165, open

165, exterior of base and lid

167

Qiblah compass

Istanbul, AH 1223 (AD 1808–9)

Turned brass lidded case. The fly is of inscribed and painted card, with a magnetized iron cross beneath and a brass ferrule in the centre; it rests on a brass pivot and is protected by glass, which is held in place by a sprung brass retaining ring
diameter 10.5 cm
height 5.7 cm
maker Ahmad, time-keeper of the Osmaniye mosque
accession no. SCI275
published Geneva 1995, no.63

A depiction of the Ka'bah lies near the circumference of the circular card, or fly, and is surrounded by a gold disc containing eight cartouches. Within these the four cardinal points are marked in black, and four intermediary points, which were given the names of the relevant winds, are in red, as recommended by Piri Reis in his *Book of Seamanship* (see cat.173 below).[1] From the Ka'bah disc radiates a fan-shaped table inscribed with the names of places ranging from the Ottoman cities of Urfa, Diyarbakır, Erzurum and Mosul in the east to Fez, Barbary, the Canary Islands and 'the Spanish New World' in the west. The whole disc is edged with a gold band and a frill of petals, with the signature of the maker in the gold band, opposite the Ka'bah disc. He was an astronomer named 'Ali who was time-keeperof the Osmaniye, that is, the Nuruosmaniye, mosque in Istanbul.[2]

Some of the names on the instrument described here – inside the fan and the two arcs beyond the zigzag line – are legible. Those within the blades of the fan are a combination of coastal and inland cities of varying importance, but none have any latitudes written above them, or anywhere else.

The fly rotates freely on the brass pivot, and the magnetized iron cross under it is so placed that when the fly stops turning and is aligned on the magnetic meridian the radial band of the 'fan' containing a given place name indicates the direction of Mecca from that place.

The fly, and the place-names written on it, which include a number of ports, might suggest that the instrument was intended for use at sea. A comparable qiblah compass, with a card including the names of places 'to which sailors direct themselves' and their latitudes is in the National Museum, Damascus.[3]

1. Kahane, Kahane & Tietze 1957, no.603.
2. Hochhut 1986, pp.15–16.
3. al-'Ush, Joundi & Zouhdi 1976, p.227, no.A4468.

167, underside of fly

167

The *dā'irat al-mu'addil*

In the mid-15th century an Egyptian astronomer called 'Abd al-'Aziz ibn Muhammad al-Wafa'i al-Miqati, who was timekeeper (*muwaqqit*) at the mosque of al-Mu'ayyad in Cairo, invented an instrument that combined a qiblah compass with a sundial, which he called the *dā'irat al-mu'addil* ('equatorial circle').[1] It was described by him and by later astronomers, including the Turkish admiral Seydi Ali Reis.[2] Perhaps as a result of the work of Seydi Ali, the instrument became popular in Ottoman Turkey, but it was not represented in Western collections and was as a consequence not mentioned in the literature on Islamic science. Interest was aroused because of a happy coincidence in 1976, when the editors of Seydi Ali's text were shown photographs of two Ottoman examples in Damascus,[3] and since then others have been recorded in Istanbul and Kuwait, and two have been sold by auction in London.[4] The Khalili Collection is therefore fortunate in possessing two of these interesting and somewhat rare instruments, cat.168 and 169 below.

The function of qiblah compass was performed by the circular base plate. This had a magnetic compass inserted in it, while the circumference of the plate was inscribed with the names of cities arranged at intervals according to the system employed in traditional Islamic geography. When the compass was aligned with magnetic north, the azimuth of the qiblah at a particular location could be established by following an imaginary line from the centre of the instrument through the mark on the circumference associated with that location (if shown); in other words, the marks on the circumference showed the direction of Makkah once the compass was aligned correctly. The other functions of the equatorial circle required the use of the sundial, which is in the form of a graduated semicircle of almost the same diameter as the base, to which it was attached by hinges. The dial could be adjusted to the plane of the celestial equator for any latitude by tilting it through an arc of 90°, a manoeuvre that was regulated by the graduated vertical quadrant set at right angles to the dial, which was then oriented on the meridian by means of the compass in the base plate. Once the equatorial circle was placed correctly, it was used to ascertain the hour angle of the sun: the vertically slotted sighting device, or alidade, which was pivoted to the centre of the semicircle at one end and moved freely along the outer scale at the other, was turned until the sun, passing through the forward slot or part of the slot (the fore-sight), fell exactly on the rear slot or part of the slot (back-sight).[5] The angle of the sun, and therefore the time, was read from the scale over which the alidade moved. According to the treatises, the alidade could also be used to observe star positions, but this seems hardly practical. The equatorial circle could also be used to establish (imperfectly) the times of Muslim prayer, and some examples, such as cat.168, have additional sundials.

1. See Suter 1900, pp.177–78, no.437; Matvievskaya & Rosenfel'd 1983, II, pp.501–3, no. 437; Tekeli 1962; Janin & King 1977, p.217; King 1979, unpaginated. A *terminus ante quem* for this development is provided by the date of al-Wafa'i's death, in either AH 874 (AD 1469–70) or AH 876 (AD 1471–2).
2. Tekeli 1960; Dizer 1977; Janin & King 1977, pp.213–14, 215, 217; Brice, Imber & Lorch 1976.
3. Brice, Imber & Lorch 1976, pp.[4–5]. The first example (Damascus, National Museum, acc.no.1171) is composite, as the equinoctial circle is dated AH 1050 (AD 1640–41), and the base, which is signed *k... 'Alī*, is dated AH 1104 (AD 1692–3); see Brice, Imber & Lorch 1976, pp.[6–8], with drawing; Nasr 1976, p.44, pl.20a, with incorrect caption. The second (Damascus, National Museum, acc.no.4468) was supposedly signed by 'Abd al-Hasan al-Radi (*recte* 'Abd al-Muhsin ibn Salih al-Muradi) and dated AH 1301 (AD 1883–4). See al-'Ush, Joundi and Zouhdi 1976, p.227, no.A451; Brice, Imber & Lorch 1976, pp.[9–16], with drawing; Maddison & Turner 1976, pp.164–5, no.88.
4. Dizer 1977; King 1979, p.52, fig.1; Qaddumi *et al.* 1984, no.7; Christie's, London, 26 September 1991, lot no.80 (see cat.168); Sotheby's, London, 29 April 1993, lot no.159.
5. Unfortunately the alidade is missing from both examples in the Khalili Collection.

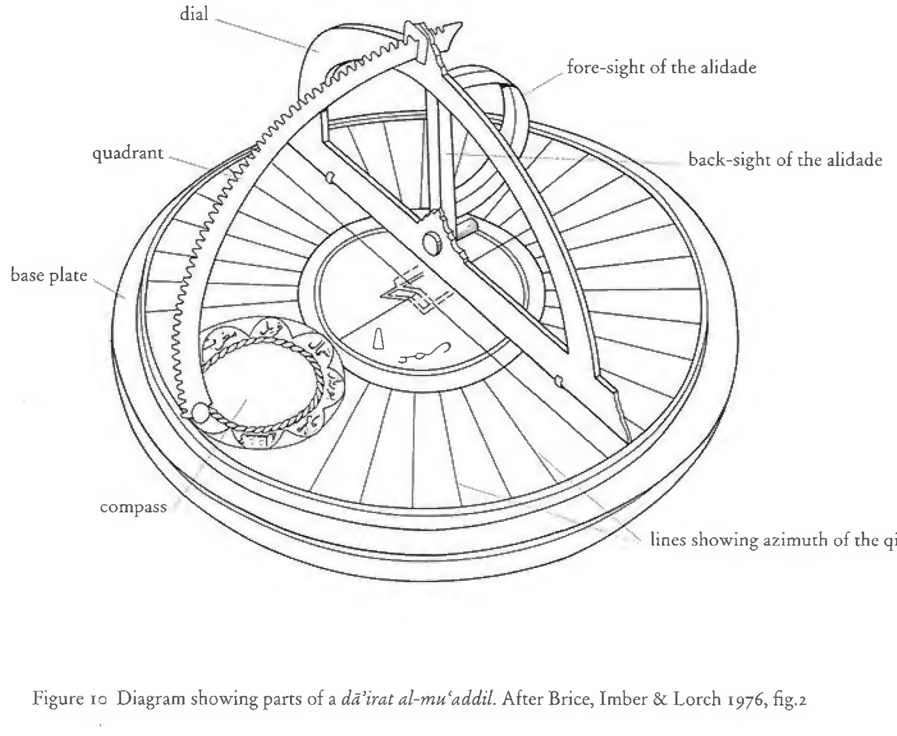

Figure 10 Diagram showing parts of a *dā'irat al-mu'addil*. After Brice, Imber & Lorch 1976, fig.2

168

Dā'irat al-mu'addil

Istanbul, dated AH 1161 (AD 1748)

Brass, beaten, cast and engraved, attached to a wooden base
height 17.3 cm *diameter* 24.2 cm
maker 'Ali al-Muwaqqit
accession no. SCI270
published Christie's, London, 26 September 1991, lot no. 80;[1] Geneva 1995, no.65

This is a complex version of a *dā'irat al-mu'addil*. The compass is recessed at the centre of the circular brass plate and can be rotated to compensate for magnetic declination, the earliest mention of which in an Islamic source is in the treatise on the *dā'irat al-mu'addil* by its mid-15th century inventor, al-Wafa'i. Around the compass is a wind-rose, with the four quarters of the compass alternating with prevailing associated winds, as on cat.167; intermediary winds (*orta*) and rhumb lines (*kerte*) are also engraved. Around the base are place-names, arranged according to traditional Islamic geography, giving the direction of Mecca from them when the instrument is aligned on the meridian. There are four levelling screws in the base.

The equinoctial (semi-)circle is adjusted for latitude by moving it along the vertical (semi-circular) scale, which is hinged so that it may be folded flat. The sighting device, originally centrally pivoted on the equinoctial semi-circle, is missing, as is the plummet which hung in the folding frame at the north end.

There is also a universal equinoctial dial for European equal hours, where the hour scale is in the form of a crescent, the hinged gnomon of which was probably inspired by French models; and a horizontal pin-gnomon dial for equal hours before and after midday, on the back of which is roughly engraved a note and diagram giving the length of the gnomon should it be lost. On the central compass, at the south-east point, along the line from north-west to south-east, is a diagrammatic rendering of *Mihrab-i Kostantiniyye*.

The instrument is signed by its maker, 'Ali, who was a time-keeper (*muwaqqit*) at the Fatih Mosque in Istanbul. The signature and date are written on the broad diametrical band of the equinoctial (semi-)circle. A curiosity of the signature is that the name 'Ali is superimposed on the word

168, detail of compass

'amal ('work'). Another instrument of this type, similarly signed by 'Ali, is dated AH 1166 (AD 1752–3) and is now in the Museum of Kandilli Observatory, Istanbul.[2]

1. The description in Christie's catalogue, with a useful bibliography, is the basis of the description given here.
2. Brieux & Maddison, forthcoming, 'Abū'l-Fatḥ 'Alī 2'.

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Dā'irat al-mu'addil

Turkey, late 18th century

A wooden disc 16.5 cm in diameter, painted in colours and gold and varnished, set with a small compass and a graduated vertical arc of 90°, made of brass and hinged so that it can lie flat; there are also a graduated semicircle and a pin gnomon, both detachable and both made of brass; the alidade is missing; height when disassembled 2.5 cm, in which state the instrument could be stored in its brown leather case, 17.8 cm in diameter, lined with marbled paper, the base covered with red velvet
accession no. SCI49
published Geneva 1995, no.64

This is an example of the combined qiblah compass and sundial known as the *dā'irat al-mu'addil*. The religious associations of the instrument are made clear by the decoration of the centre and lower part of the dial, which bears a depiction of the Ka'bah and some of the other monuments of the Haram at Mecca, in addition to the data required for its operation. Above the Ka'bah are the hour-lines of a horizontal pin-gnomon sundial, and the edge of the dial is inscribed with the principal seas, cities and countries of the known world of the classical Arab geographers, so that the piece was in some respects decidedly out of date. Above the hour lines the dial is set with a compass, which is surrounded by an eight-lobed rosette, the four quarters alternating with Turkish wind names. A craftsman's inscription written below the compass is now largely illegible, but what remains, *[r]asamahu al-faqīr ... īm Khān* ('Drawn by the needy ...im Khan'), suggests that the maker was associated with the reigning sultan or an imperial mosque, for the title 'khan' was only used by the sovereign.

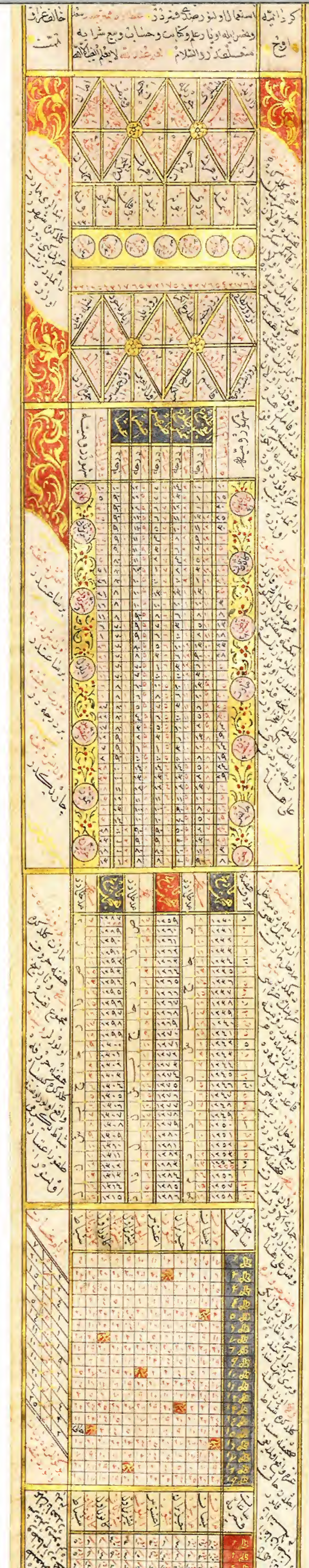
Qiblah compasses and sundials are recorded in Ottoman Turkey from the late 16th century.[1]

1. An ivory compass in the British Museum (inv. no.90.3.154), though not a *dā'irat al-mu'addil*, is signed by Bayram ibn Ilyas and dated AH 990 (AD 1582–3); see Vienna 1983, no.27/4.

169; view of dial

169

168, open



Three *ruznames*[1]

Small, decorative almanacs or calendar scrolls, usually on parchment and of a size suitable for the pocket, were produced in Ottoman Turkey from at least the 17th century.[2] The almanac is usually that associated with a certain Darandeli Mehmed Efendi, who created an almanac for Istanbul. Nothing is known about this author, except that he, or his family, came from the town of Darende in central Anatolia.[3] Such almanacs are not very common, and those known are of the 18th and 19th centuries. They are usually written in black and coloured inks, with gold, silver and coloured ornamentation, have a leather flap and a wooden roll with bone finials.[4] There also exists a scroll almanac of this type printed on paper.[5] The known almanacs vary in length, but usually give tables of the times of Muslim prayers for each month of the solar year, and other times of religious importance; the length of day and night, and the time of nightfall; the time when the sun is in the direction of Mecca (data usable also for the orientation of mosques); and information for calendar-calculation correlating the lunar calendar with the days of the week, and with the Rumi calendar, which was the Syro-Arab version of the Julian calendar. I

1. This note, and the descriptions that follow for cat.170–173, are reprinted, with additions, from the text written by J.M. Rogers and Francis Maddison in Geneva 1995, cat.70–72 and cat.75.
2. For the 15th-century *ruzname* by Shaykh Vefa, of a different type, see King 1980, p.247.
3. King 1980, pp.249–50.
4. Such as that in the Museum of the History of Science, Oxford University, MS.1949–50, dated *circa* 1795, this has a peasant's calendar in Turkish on the back. Other examples are an almanac signed by Sulayman, known as al-Hikmati, and dated AH 1174 or1194, formerly in the Destombes Collection, Paris (Maddison & Turner 1976, pp.174–175, no.98) and now in the Institut du Monde arabe, Paris (Mouliérac 1989, pp.118–19); that in the Chester Beatty Library, Dublin (Minorsky 1958, pp.127–8, no.481); that in the Musée du Temps, Besançon (Turner 1990); that in the Time Museum, Rockford, IL (unpublished); and two others in a private collection, Paris.
5. Recently sold to a private collection in Vicenza.

opposite, left 170; right 171, detail

170

Calendar scroll

Ottoman Turkey,
dated AH 1012 (AD 1603–4)

Parchment scroll in vertical format on a wooden scroll, 100.7 × 8.8 cm, including flap; text written in *naskh* script in black and carmine inks with panels of carmine inscribed in gold; initial dark brown leather flap with a lobed lozenge filled with arabesque decoration, painted in gold; tied with a silk string; contained in a papier-mâché cylinder case trimmed with leather and covered with marbled paper
signed al-Sayyid Hasan al-Hilmi
accession no. MSS43
published Geneva 1995, cat. no.70

The scroll has an illuminated heading with an inscription that announces 'This is the calendar by Darandeli' (*Hādhā ruznāmah-i Darandalī*).[1] The manuscript ws written in Arabic, while a Turkish text in the right-hand margin may be an almanac. The illumination is so characteristic of the early 19th century, however, that it is tempting to believe that the date given relates to the date of the calendar copied, a not unusual occurrence – a scroll in Oxford, datable to the period *circa* 1795,[2] is almost identical. This is an indication that workshops in later Ottoman Turkey continued to produce these scrolls as standard works of information.

1. King 1980, pp.249–50; King 1985.
2. Museum of the History of Science, Oxford University, MS.1949–50; Frankfurt 1985, no.12/1.

171

Calendar scroll

Ottoman Turkey,
dated AH 1220 (AD 1805–6)

Parchment scroll in vertical format, 115 × 6.2 cm; in *naskh* script, written and illuminated in black, deep blue, gold and carmine inks
signed (twice) Muhammad al-ma'ruf bi-Na'ili Yaziji
accession no. MSS736
published Sotheby's, 15 April 1985, lot no.312; Geneva 1995, cat. no.71

This untitled scroll carries two signatures of the scribe, one in the gold roundel above the *'unwan*, and a shorter version at the end of the scroll. The margins contain explanations of or commentaries on the tables, while the head-piece contains the depiction of a Mevlevi bonnet (*tac*).

172

Calendar scroll

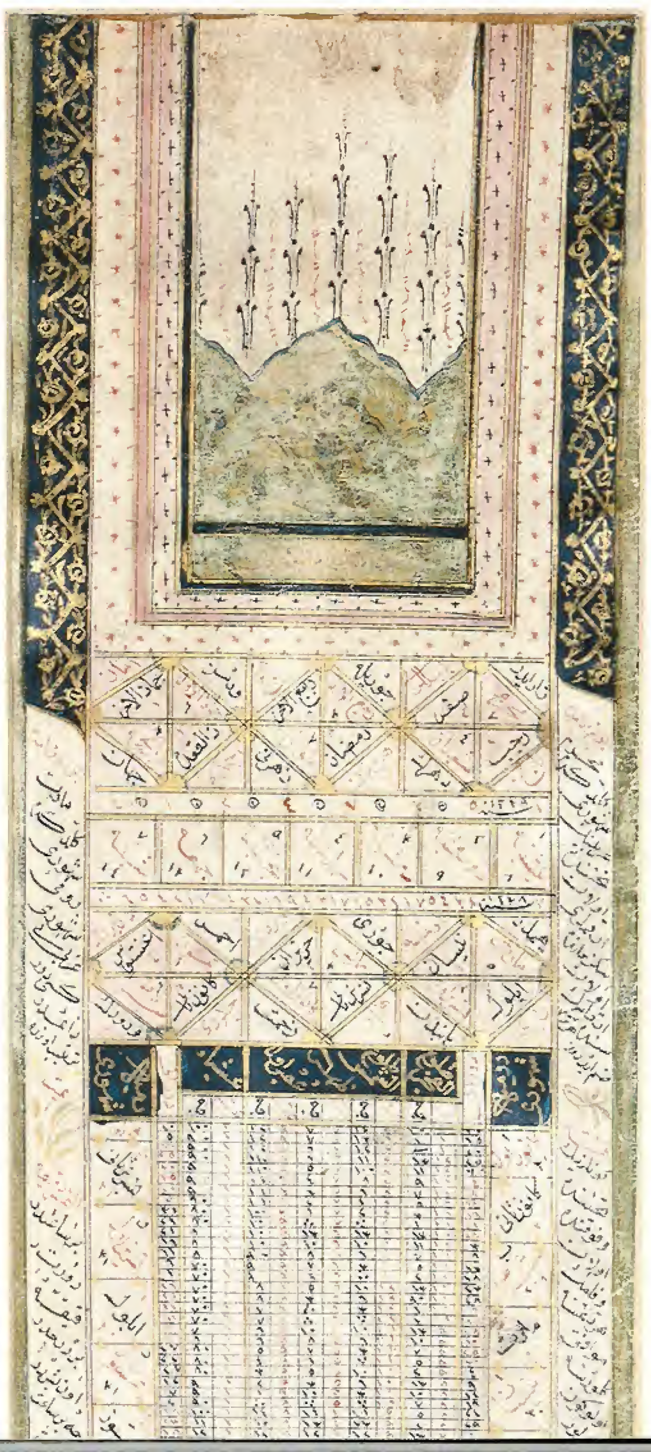
Ottoman Turkey, dated AH 1270
(AD 1853–4)

Cream paper scroll in vertical format, 78.5 × 9.4 cm; written in black and carmine ink in panels framed in gold and black, and in gold on black panels
signed al-Sayyid Muhammad al-ma'ruf bi-Hikmati
accession no. MSS757
published Christie's, 16 June 1987, lot no.56; Geneva 1995, cat. no.72

Like cat.170, the data contained in the document are valid for the latitude of Istanbul. The scribe evidently specialized in the production of such scrolls.[1]

The heading now appears rather dull, though it was originally illuminated and had a title in gold. The paper appears pink within certain columns, including some of those with black script: this may be deliberate highlighting rather than the result of the carmine ink having run. Several errors have been corrected in black on gold.

1. Sotheby's, London, 16 April 1986, lot no.231 and Sotheby's, London, 20 November 1986, lot no.252, both bear his signature.



172, detail

173, folios 3b–4a

173, folios 28b–29a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THE NOUR FOUNDATION

O.L.G.

THE NASSER D. KHALILI COLLECTION OF ISLAMIC ART

VOLUME XII

Part Two

General Editor Julian Raby

The Nour Foundation
in association with
Azimuth Editions and Oxford University Press

SCIENCE, TOOLS & MAGIC

Part Two. Mundane Worlds

by Emilie Savage-Smith
with contributions from Francis Maddison,
Ralph Pinder-Wilson and Tim Stanley

Published in the United Kingdom
by The Nour Foundation
in association with Azimuth Editions
and Oxford University Press

The Nour Foundation is part of The Khalili Family Trust

The Nour Foundation
Nour House, 6 Hill Street, London W1X 7FU, England

Azimuth Editions
33 Ladbroke Grove, London W11 3AY, England
Edited by Julian Raby and Alison Effeny
Design by Anikst Associates

Oxford University Press, Walton Street, Oxford OX2 6DP

Oxford New York
Athens Auckland Bangkok
Bombay Calcutta Cape Town Dar es Salaam Delhi
Florence Hong Kong Istanbul Karachi Kuala Lumpur
Madras Madrid Melbourne Mexico City
Nairobi Paris Singapore Taipei Tokyo Toronto
and associated companies in
Berlin Ibadan

Oxford is a trade mark of Oxford University Press

Published in the United States
by The Nour Foundation
in association with Azimuth Editions
and Oxford University Press Inc., New York

British Library Cataloguing in Publication Data
Maddison, Francis
Science, tools & magic. – (The Nasser D. Khalili Collection of Islamic Art; v.12)
1. Art, Islamic
I. Title II. Savage-Smith, Emilie III. Nour Foundation IV. Nasser D. Khalili Collection of Islamic Art V. Body and spirit VI. Mundane worlds
704. 2'971
ISBN 0-19-727610-5

Library of Congress Cataloging in Publication Data
(data applied for)
ISBN 0-19-727610-5

Photography by Christopher Phillips

Typeset by Azimuth Editions
Printed on acid-free paper by PJ Reproductions, London

Contents

Mundane Worlds

Mortars and pestles

by Emilie Savage-Smith

Mortars and pestles were common items of scientific equipment throughout the Islamic world. They were used by all druggists in the preparation of their medicaments, as well as by alchemists and artisans, such as goldsmiths and preparers of inks, pigments and glues. In households cooks used small mortars to pulverize seeds and herbs or break sugar from sugar loaves. The more mundane forms, made of stone or wood, have tended not to be preserved. All the mortars surviving from the medieval Islamic world, of which there are a considerable number, are of cast metal with the handle, when there is one, an integral part of the main casting. Rings that were sometimes inserted through the pierced handles were produced by a separate casting, or from twisted, heavy-gauge wire.[1] Some, especially those from eastern provinces, are highly decorated and inlaid with silver and copper (cat.196, for example). Others have less elaborate decoration, while the Spanish–Islamic mortars (cat.174 and 175) are striking in the clean lines of their utilitarian design.

Mortars developed out of basic grinding tools used for grains and seeds, one variety being a quern, consisting of an upper convex and lower concave stone.[2] According to the Ebers Papyrus of about 1550 BC, the Egyptians used mortars for pulverizing acacia. The Greeks used a marble spouted mortar and the Romans a shallower version called a *mortarium*, in addition to deep stone mortars for items that required greater pressure. Purbeck 'marble' (a fossiliferous limestone) and Portland stone (a fine-grained limestone) were materials from which the mortars were commonly made.[3] Roots, rhizomes, dried herbs, earths and even minerals were crushed with a mortar and pestle before being added to decoctions and tinctures or combined to form powders or ointments. Both wet and dry ingredients would be mixed in a mortar and poured out from the spout that was a common feature of Graeco-Roman mortars.

While large numbers of marble mortars of the Roman period have been excavated, finds of metal mortars are rare, though at least two small bronze mortars have been found with instruments of Roman surgeons and oculists.[4] According to some scholars, there are references to metal mortars in Hellenistic and Byzantine medical writings. One clear indication of their use is given by the 2nd-century physician Galen, who recommended using a bronze mortar (ἴγδις) and a copper pestle (δοῖδυξ), in particular ones made from a red alloy, and the urine of a boy to produce – by the interaction of an acid on copper – verdigris, which had many medical uses.[5] Galen, however, provides no evidence that a metal mortar and pestle was used for any other purpose. In the 7th-century Greek medical encyclopaedia written by Paul of Aegina in Alexandria – a work translated into Arabic in the 9th century, when Galen's writings were also translated – there are several references to the use of a lead mortar (μολύβδιον ἰγδίον). He recommended, for example, that haemorrhoids be treated with ashes of dried ivy leaves pounded with rose oil in a lead mortar.[6]

Whatever their use in the Roman world, by the 10th century metal mortars had become a common utensil in the Islamic world. The physician Abu Bakr Muhammad ibn Zakariya' al-Razi (d. 925) used two words for mortars, the Arabic *mihrās* and the Persian *hāvan*, and in the next century the polymath al-Biruni noted that mortars were made of an alloy called batruy, which he said was made of copper and lead.[7] This statement is interesting in the light of both Paul of Aegina's specification of lead mortars, and the relatively high lead content of some surviving Islamic mortars (see below, pp.295–6).

There are some general features which differentiate Islamic products from those of medieval and Renaissance Europe. Polygonally-sided mortars are distinctly Islamic, and almond- or teardrop-shaped bosses seem to occur only on Islamic products. On the other hand, there are European designs that have no Middle Eastern equivalents, such as the

double-ended pestle or the enormous post-medieval mortars, weighing 50 to 100 kilograms and mounted on wooden blocks, used with a large pestle suspended from the ceiling.[8] Islamic metal mortars are also very seldom dated, whereas European ones frequently are, one of the earliest, now in the Yorkshire Museum in York, being dated 1308. Cylindrical, with a slightly flaring base and rim and two large handles cast to resemble a twisted rope, it bears no similarities in design and decoration with any known Islamic examples.[9]

A comprehensive typology of all Islamic types of mortars in terms of design and time and place of production has yet to be established. An important preliminary attempt based on profile forms – rim, base, body shape, bosses, handles – was undertaken by James Allan in an unpublished dissertation.[10] In Table 3, the examples in the Khalili Collection have been classified using the same typological categories established by Allan, with the addition of categories for the Spanish-Islamic mortars, Type 1, and those exemplifying Type 2.

The Khalili Collection includes 18 items that represent seven distinct types or classes of Islamic mortars. Those of Type 1 are of Spanish-Islamic origin: they are small mortars with alternating lancet-shaped bosses on a cylindrical body. There are usually two small handles, and cat.174 and 175 are good examples of the type.[11] The design of these Spanish-Islamic mortars can be seen to have influenced some of the earliest Italian cast mortars. A subgroup of Type 1 (which is not represented in the Khalili Collection) have inscriptions or decorations inscribed above and below the lancet-shaped bosses. A number of the latter were found in a shipwreck off the Algerian coast and are attributed to the 11th or 12th centuries.[12]

Type 2 is a handleless cylindrical form of mortar with a slightly flared rim (cat.176, 178, 179, 181 and 183). The decoration on this style of mortar consists of sparsely placed large almond- or teardrop-shaped bosses, alternating in orientation and staggered in placement. There is incised decoration near the rim and base and between the bosses. Although generally ascribed to Iran, they have sufficient characteristics in common with some varieties of Spanish-Islamic mortars to suggest a more western, possibly Syro-Egyptian, origin. All recorded examples, however, are unprovenanced and provide few clues as to their time or place of production.

Type 3 appears to be from Anatolia or the Jazirah. Such mortars are all octagonal with wide and flat rims and bases joined to the body by a 45° chamfer. The handles are animal-headed with large rings inserted through them. Cat.187 and 188 relate in form to those excavated on shipwrecks amongst cargo containing Mamluk coins, of which the most recent was minted in 1404. In the case of cat.185 and 189, the rim and base are not linked to the body by as angled a chamfer, nor are the edges of the eight faces as pronounced. Many examples of Type 3 mortars have engraved arcading flanking the bosses, all of which face upward. Mortars of this type are mostly of Anatolian origin, and there is one example of Anatolian provenance that has a recessed niche flanked by arcading on each face, in imitation of architectural forms.[13]

Type 4 are handleless, bucket-shaped mortars with relatively small, slightly flaring rims and bases, and probably come from Transoxiana. Two examples in the Collection (cat.191 and 193) are of the late 12th or 13th century.

Type 5 mortars are apparently Khurasanian products, characterized by a waisted cylindrical form, with no handles. There are usually raised lozenges between almond-shaped bosses and tight scrollwork forming a ground for decorations and inscriptions. This common form of Islamic mortar is exemplified by cat.194 and 196, the latter being an especially fine example of inlaid metalwork from the early 13th century.

TABLE 3. CLASSIFICATION OF MORTARS IN THE KHALILI COLLECTION, BY PROFILE[1]

	TYPE 1		TYPE 2					TYPE 3				TYPE 4		TYPE 5		TYPE 6	TYPE 7		UNIQUE FORMS	
	cat.174	cat.175	cat.176	cat.178	cat.179	cat.181	cat.183	cat.185	cat.187	cat.188	cat.189	cat.191	cat.193	cat.194	cat.196	cat.197	cat.199	cat.201	cat.202	cat.203
A. No rim / No base	•																			
B. Rim slightly flaring / No base		•	•	•	•	•	•													
i. Cylindrical	•	•	•	•	•	•	•													
a. No handles			•	•	•	•														
2. Bosses – almond			•	•	•	•	•													
b. Handles	•	•					•													
3. Bosses – elongated	•	•																		
C. Rim and base, flaring								•	•	•	•	•	•	•	•		•	•	•	•
i (1). Cylindrical – bulging												•	•							
a. No handles												•	•							
2. Bosses – almond												•	•							
i (2). Cylindrical – waisted														•	•					
a. No handles														•	•					
3. Bosses – mixed														•	•					
i (3). Cylindrical – cabled																	•	•		
a. No handles																	•	•		
1. No bosses																	•	•		
ii. Octagonal								•	•	•	•								•	•
b. One-handled										•	•									•
2. Bosses – almond										•	•									
3. Bosses – lion-heads																				•
c. Two-handled									•										•	
2. Bosses – almond									•										•	
d. Four-handled								•												
2. Bosses – almond								•												
D. Base angular / Rim flat																•				
ii. Octagonal																•				
a. No handles																•				
1. No bosses																•				

1. The classification employed here is based on the typology of profile forms developed by James Allan (1976, 1, pp.234–40). A few minor modifications have been introduced.

TYPE 1 (cat.174)

TYPE 2 (cat.176)

TYPE 3 (cat.187)

TYPE 4 (cat.193)

TYPE 5 (cat.194)

TYPE 6 (cat.197)

TYPE 7 (cat.199)

Type 6 is octagonal in form with a wide, flaring base and rim. These handleless mortars are decorated with running animals, especially dogs and hares, and other decorative motifs typical of 12th- and 13th-century products from Khurasan. There is only one example in the Khalili Collection, cat.197.

The final group of Islamic mortars represented in the Khalili Collection, Type 7, are probably later products from eastern Iran. Mortars of this type, such as cat.199 and 201, have torus mouldings or cables around a cylindrical body with a gently angled rim and base. They also have no handles, but usually have inlaid decorations incorporating eternal knots and, occasionally, crescent moons. The poorly formed inscriptions on the objects suggest copying from earlier examples.

In addition to these seven clearly identifiable types, the Khalili Collection also includes two mortars that are unlike any other recorded examples, cat.202 and 203. They have the octagonal form characteristic of certain classes of Islamic mortars, yet there are other features that have not yet been documented in Islamic items. They might, therefore, reflect European influence on Islamic mortar production or even be the work of Islamic artisans who migrated to Europe.

The salient characteristics of all these groups, and suggestions as to their provenance and date, are given in the short introduction to each type in the catalogue section, which has been arranged so that the types follow a rough west-to-east geographical progression, from Spain to Khurasan or Central Asia.

It is worth noting that mortars depicted in paintings are of a rather different design from surviving examples, the most obvious variation being that the painters never showed mortars of octagonal form, nor the existence of bosses. In a dispersed Dioscorides manuscript copied in Baghdad in 1224 there are two illustrations that include mortars. One shows an undecorated cylindrical mortar, without a rim or projecting base, but with two loop handles at the top edge, resting on the ground in front of the druggist; the other depicts a mortar that is wider at the bottom than at the top, with two loop handles at the top edge and decoration of medallions framed by curling vines on the conical body.[14] In a Mughal miniature of 1590 depicting the death of Babur, the mortar being using by an attendant physician is very large, waisted and cyclindrical, with no decoration or bosses,[15] while one shown in a Mughal painting of the celebrations at the birth of Timur, made about 1604, is so waisted as to be hour-glass in shape and appears more European than Islamic in style.[16] Another Mughal miniature, datable to 1605–6, depicts an undecorated cylindrical mortar with a rim slightly broader than the circular base.[17] In a painting made in 1605–6 in a copy of Firdawsi's *Shāhnāmah*, the mortar appears to be undecorated apart from cables, and is cylindrical in form with no base and little rim.[18] Miniature painters thus appear to have produced simplified and schematic renderings of mortars, though sufficient detail is given in some Mughal paintings to suggest familiarity with European mortars.

While mortars present a variety of forms and designs, pestles are much simpler, there being only two Islamic types, banded and unbanded.[19] The banded form has, as part of the original casting, a ring or cable which is positioned near the middle of the pestle. The handle is usually a spherical or ovoid knob and the pounding end is slightly flared. The purpose of the band would seem to be to prevent the hand from hitting the edge of the mortar while pounding. While it is seldom certain that a pestle was manufactured to go with a particular mortar, the fact that the band should be above the rim of a mortar when the pestle rests in it permits one to dismiss some mortars as potential partners for a pestle. Occasionally, a pestle has some silver-inlaid decoration or even inscription (for example, cat.190 and 200),

but these give few clues as to time and place of production. In cases where the silver inlay occurs on the lower half of the pestle or near the flared pounding head, as it does in cat. 200, such a pestle cannot have been intended for use with liquids or acidic substances.

Materials and techniques of manufacture

All Islamic mortars, and indeed probably all other ones made of metal, are cast in the manner of a bell;[20] the pouring point is at the top of the mould, which, when inverted, becomes the bottom of the mortar. In some cases it is evident that porosity occurred at the sprue or pouring point as the casting cooled. There are several examples in which a cast-in plug has been placed in the bottom of the mortar at the time of manufacture, apparently to repair the casting flaw.[21] Cat. 196, a mortar of Type 5, has a similar plug at the bottom, though it was possibly a later repair.

The structural strength of a mortar, which is subjected to great pressures and repeated blows, is to a large extent dependent on the alloy from which it is cast, as well as the form and thickness of the mould. In recent years, 15 Islamic mortars have ben tested metallurgically and found to contain a significant amount of lead in the alloy. Six Spanish-Islamic examples were examined, and of these, three – all with a rim and 14 ribs – were found to be of a leaded tin brass, with the lead varying from 5.2 to 13.05% and the tin from 1.8 to 2.82%.[22] The remaining three Spanish-Islamic mortars are of a different form – they have fewer ribs and are rimless – and the analyses indicated their alloys to be a leaded bronze in two cases and in the third a leaded zinc bronze, with lead content varying from 3.38 to 9.31%.[23]

Nine mortars from other regions of the Islamic world, tested in other laboratories, display a substantial amount of lead in the alloy, varying from 10.4% to 34%. Five were leaded tin brasses with tin varying from 2.7 to 3.6% and zinc between 5.8 and 8.6%.[24] The other four mortars were leaded bronzes, with tin varying from 3.2 to 6.1% and the zinc from 0.04 to 1.7%.[25]

There are inherent difficulties in comparing the results of such metallurgical analyses from different laboratories, and many more objects need to be carefully tested before firm conclusions can be drawn from the data. Sampling points may prove crucial, for lead tends to segregate in leaded alloys, and different readings can be obtained from the same object.[26] Furthermore, the calibration of instrumentation between laboratories, or even within a laboratory where equipment and material may change, is a vexing problem when interpreting analytical test results. It is also possible that the composition of the alloys might vary enormously from one workshop to another and between batches of alloys within a workshop. Further systematic metallurgical analyses will be required before any useful correlation with observable features can be established and any attempt made to categorize products from various regions on the basis of their metallurgical composition. It is possible that, with casting being carried out using alloys casually produced from available older pieces of metalwork, there may never be sufficient consistency within workshops or regions to allow differentiation.

Heavily leaded alloys, particularly the heavily leaded brasses, have been termed quaternary alloys.[27] In such an alloy the lead comprises 13% to 40%, zinc 5 to 15% and tin 1 to 8% of the alloy. Such a mixed alloy was probably derived from melting down old bronzes and brasses, and adding lead to aid in the casting.[28] This reduced the cost of the object, made it easier to cast, and produced an object that was heavier and hence more stable when in use.

A relatively high-lead content in Islamic metal mortars would, however, have led to disadvantages of a technical and a medical kind. The bulging underside that is seen on many

Islamic mortars is usually said to be the result of deformation through pounding with a pestle. Certainly, a heavily leaded alloy would be more vulnerable to such deformation, and on a number of mortars, such as cat.185, 189, 199 and 202, the curvature of the base is evident. In some cases, however, the bulging underside has no corresponding depression on the inside (cat.176, 179 and 183); and in others, such as cat.187, the bottom is flat on both sides and quite thick. There are also some mortars (cat.197 and 201) that have undersides that are unsupported, for the flared base angles downwards sufficiently to raise the underside from the surface on which the mortar rests. It is interesting that the interior surface of the base of these two examples has remained quite flat, which suggests that they are made of an alloy with a small lead content. Mortars that have a base – often fairly thick – with a bulge of differing internal and external curvature, such as cat.176, 179 and 183, raise the possibility that some mortars may have been cast with a convex underside, so that they would sit securely on a cushion or other flexible surface that would give on impact.

Mortars with handles could also have been stabilized by tying the handles to a solid support. The cushion, absorbing the impact as the pestle struck the mortar and its contents, would then prevent the mortar from moving about while in use. Using a cushion allows for greater impact of the pestle than resting a flat mortar on a flat hard surface. Furthermore, if the mortar was always placed on a hard surface while being used, it is unlikely that the lower surface would suffer deformation. Only if the mortar were used on a cushion – or possibly the ground – that absorbed the impact, could the bottom become deformed. To produce deformity in this manner would, however, require an extraordinary amount of force, given the thickness of most mortars. Moreover, in European mortars a similar deformation is seldom found. Consequently, we might conjecture that some Islamic mortars were customarily used while resting on a cushion or the ground or similar soft surface and that to facilitate this a convex underside was sometimes part of the original casting. In those instances when it was not intentional, the deformation most likely occurred in vessels with thinner bases and cast from a leaded alloy.

A more serious disadvantage of a heavily leaded alloy, however, is that certain substances, particularly acidic ones, could interact with the lead to cause a form of lead-poisoning in the user, if the contents were consumed in sufficient quantities. This of course assumes that the contents were intended for internal consumption and we know that some mortars, if not the majority of them, were in fact used for culinary purposes. Those vessels used to prepare medicaments could also be injurious, for the application of lead compounds to excoriated skin over an extended period of time can lead to chronic lead-poisoning, though lead products were frequently specified ingredients in compound remedies for skin conditions. The maceration of medicaments with wine, a common practice, could produce similar contamination.[29] Certainly metal mortars could be affected by acids, and particles could be rubbed off during use. As we have seen, al-Biruni's statement that the alloy used for mortars was a lead-brass is supported by the few metallurgical tests conducted to date, which indicate a substantial proportion of lead in the alloy. The irony of using an alloy containing lead – known since Roman days to be hazardous if consumed – in a mortar that frequently carried benedictory wishes of good health to its owner has been noted by historians.[30]

1. Some of the preserved metal mortars are heavily corroded or pitted on the inside and show signs of extensive use. Occasionally they are encrusted inside and out with a verdigris (carbonate of copper) patina suggesting that they have been buried or been underwater for a long period of time.
2. See Matthews 1983, pp.7–11.
3. A bas-relief found at Epinal in France, dating to the 2nd century AD, illustrates a Roman mortar. It is now in the Musée des Antiquités Nationales, St Germain-en-Laye and illustrated in Cowen & Helfand 1990, p.32; see also Scarborough 1969, pl.32.
4. For an illustration of a Roman bronze mortar, see Milne 1907, pl.LII fig.3; see also pp.165–6 for references to others.
5. For a translation of this passage from *De simplicium medicamentorum*, see Milne 1907, p.166.
6. Paul of Aegina, I, pp.660–62 (Book III, 59); for an anodyne compound for eye pain, Paul recommends that one should grind ceruse (white lead) to a fine powder along with wine and rose oil in a lead mortar. See Milne 1907, p.166.
7. For the treatises by al-Razi and al-Biruni in which these terms occur, and the interpretation of the terms, see Allan 1976, I, pp.237–8, and Allan 1979, p.52.
8. For an illustration of one in a Dutch engraving by Philippe Galle about 1580, see Cowen & Helfand 1990, p.47; and for one in the register of the Basle apothecary H.T. Eglinger (d. 1675), see Mez-Mangold 1971, p.93.
9. It was cast by Brother William of Towthorpe for the infirmary of St Mary's Abbey in York and weighs approximately 37kg. The inscription reads 'Mortarum Sct. Jonis Ewangel. De Infirmaria Be Marie Ebo' and 'Fr. Wills De Touthorp me fecit A.D. MCCCVIII'; it has been suggested that it is the oldest dated mortar known.
10. Allan 1976, I, pp.234–40 and II, pp.649–62 and figs 35–7.
11. Other examples, apparently trade items, have been found at medieval sites in England and Wales.
12. Golvin 1962.
13. See Geneva 1985, p.270, where it is attributed to the 13th or 14th century.
14. Metropolitan Museum of Art, New York, inv. no.13.152.6, and Freer Gallery of Art, Smithsonian Institution, Washington, DC, inv. no.32.20v; Brandenburg 1984, p.127; Savage-Smith 1993, p.220.
15. British Library, London, MS.Or.3714, fol.70a; reproduced in Savage-Smith 1993, p.222.
16. British Library, London, MS.Or.12988, fol.34b, painted by Sur Das Gujarati; reproduced in Losty 1986, p.32. Virtually the same mortar and pestle are shown in a related painting, made perhaps slightly earlier and executed by Bhim Gujarati with faces by Dharm Das, now in Massachusetts, Worcester Museum; see Findly 1981, p.22, illustrated on p.23.
17. From a copy of the *Bustān* of Sa'di painted by Abu'l Hasan. Houston, Art & History Trust Collection, inv.no.137, fol.178b; reproduced in Soudavar 1992, p.352, no.137s.
18. St Andrews University, Islamic MS.28 (PK 6455.A1), fol.52a; reproduced in Savage-Smith 1993, p.209.
19. See Allan 1976, I, p.241 and II, pp.663–4.
20. The eventual predominance of casting in European mortar production may well have been another aspect of technology inherited from the Islamic world: military excursions and trade routes provided ample opportunity for the transmission of information and technology from one region to another around the Mediterranean rim. Suppliers of pharmaceutical and chemical equipment in Europe were clearly influenced by various Islamic practices, for example, in the form of the drug jar known in Europe as an albarello, which was first made in Syria in the 12th and 13th centuries.
21. See, for example, Victoria & Albert Museum, London, inv. nos M.111–1929 and 466–1876; see Melikian-Chirvani 1982, pp.110–11 and 160–61. Another mortar in the Victoria & Albert Museum, inv. no.M.292–1956, is described as having the 'bottom pushed out by continuous pounding over an extended period', but it may be the plug that was pushed out, since such plugs must have been potential weak points in the structure; see Melikian-Chirvani 1982, pp.134–5.
22. The mortars were British Museum, London, Department of Oriental Antiquities, inv. no.1907.11–9.6; Ashmolean Museum, Oxford, inv. no.1952–182; and one in the Fitzwilliam Museum, Cambridge; for the results, see Lewis 1984, pp.329–35. An analysis of the British Museum mortar has also been published by Craddock (1990, p.99).
23. British Museum, London, inv. no.1907.11–9.5; Victoria & Albert Museum, London, inv. nos M.17–1938 and M.16–1938. The zinc was negligible (less that 0.02%) in the first two but was 2.93% in the third. The tin content of Victoria & Albert Museum, inv.no. M.17–1938 is relatively high (12.10%). Tests published by Lewis (1984) and Craddock (1990, p.99).
24. British Museum, London, Department of Oriental Antiquities, inv. nos 1956.VII–26.4, 1883.X–20.7 and A. Rigby Loan 3 (results published by Craddock 1990, p.99); Ashmolean Museum, Oxford, inv. no.1968.34 and Loan d.6 (Allan 1979, p.145).
25. British Museum, London, inv. nos 1939.10–18.1, 1907.11–9.1, 1907.11–9.4 and 1907.11–9.7. Results published by Craddock (1990, p.99).
26. See Kaczmarczyk & Hedges 1979, p.149, for the difficulties of testing lead-rich objects.
27. See Kaczmarczyk & Hedges 1979. P.T. Craddock has objected to the term, because the amount of tin is too low to be a deliberate component (Craddock 1979, p.73).
28. Craddock 1990, p.77.
29. Nriagu 1983, pp.366–8; see also pp.331–8 for food prepared in lead vessels. See also Riddle 1985, pp.153–4; Scarborough 1984.
30. J.M. Rogers (1977, p.238) notes that the irony was not apparently intentional, since benedictory formulas are common on other types of metalwork that are not made of potentially hazardous alloys.

Type 1.
Spanish-Islamic mortars

The design of the mortars in this group is characterized by a series of elongated, angular bosses, alternating in orientation, on a cylindrical body that has no base and either no rim or one that flares only slightly. These triangular, lancet-shaped projections are positioned about the middle of the vessel leaving zones of equal size above and below. There may be one handle, but more usually two, with rings attached, and the handles have engraved lines or indentations, which may be traces of an earlier animal-head motif.

The type is associated with the Iberian peninsula. Two Spanish-Islamic examples in the Khalili Collection (cat.174 and 175), conjecturally dated to the 13th or 14th centuries, represent the continuation of a design which remained virtually unchanged for centuries and which passed from the Iberian peninsula to Italy, where it is associated with some of the earliest surviving Italian mortars.

The few published accounts of this type of mortar have tended to confuse the products of Spanish, Italian and other European workshops, and have failed to establish a reliable chronology for western Islamic mortars.[1] Amongst the earliest extant examples of Spanish-Islamic mortars with lancet-shaped flanges, dating possibly from the 10th century, are one now in Palermo that has a lion-headed handle and one in the Keir Collection with a lion's head in high relief on the side opposite the handle.[2] At Illiberis (Elvira) in Spain, a site abandoned by the beginning of the 11th century, a cylindrical mortar was found, with no rim and with flanges and handles similar in silhouette to those on cat.174, but without the indentations on the handles.[3] In Córdoba there is an example with a slightly more pronounced rim and one rectangular handle with indentations or lines on it not unlike the marks on the handles of the Khalili mortars.[4]

Related in design to cat.174 and 175 are 11 mortars found in a shipwreck off the Algerian coast west of Oran, many in fragmentary or corroded condition, and which are thought to date from the 11th or 12th centuries. They all have traces of decoration and inscriptions above and below the bosses.[5] A version of a larger Spanish-Islamic mortar with an angled rim and base rather than straight cylindrical sides is represented by an example found near Palencia in northern Spain.[6] This type also has inscriptions and decoration incised on the upper and lower zones, as well as some decoration between the bosses, with either an animal-head handle or a single loop handle. A related mortar, but with handles like those on Khalili cat.175 and a more cylindrical body, is now in the Sicilian National Gallery in Palermo.[7]

Another variation in the design of Spanish-Islamic mortars is represented by one in Berlin, which has a recessed narrow band beneath the rim and small almond-shaped handles with small holes for the rings, while its lancet-shaped bosses are 'two-tiered', that is, the boss appears to be set in a collar.[8] This mortar appears to be relatively early, but conceptually it represents a transitional design between Type 1 and Type 2.

On Spanish-Islamic mortars that appear to be later than the Khalili examples, the bosses tend to lose their triangular cross-section, and the bodies of the mortars become conical.[9]

Given the frequent contact between the regions in the 9th and early 10th centuries, and again at numerous times in later centuries, it is understandable that the Spanish-Islamic style of mortar would have passed through various trade routes from Spain and the western Mediterranean into Italy, influencing the design of mortars there and elsewhere in Europe, particularly after the expulsions in 1492.

1. The best accounts to date of the Spanish-Islamic mortars are given by Lewis (1984, pp.329–35) and Allan (1986, p.19). For other, similar mortars and various Italian and Spanish attributions, see Middledorf 1981, pp.24–5, and the catalogue of a sale at Christie's, London, 17 February 1982, lot nos 2, 7, 29, 31–33.
2. Sicilian National Gallery, Palermo (see Gabrieli & Scerrato 1979, p.182, no.204) and Keir Collection, Richmond, no.16 (see Fehérvári 1976, p.38 and pl.5b, where it is attributed to Iran, 9th–10th century).
3. Williams 1907, p.173, pl.33; Lewis 1984, p.29. Another example that may be rather early and has a single loop handle placed near the base is in the Museum für Kunst und Gewerbe, Hamburg; see Launert 1990, p.173, no.179, where it is catalogued as late 13th- to early 14th-century Iranian.
4. Museo Arqueológico, Córdoba; see Torres Balbás 1973, p.763, fig.619.
5. Golvin 1962.
6. Villanueva y Geltrú Museum, Barcelona, has a mortar found near Palencia, 20 centimetres high, with animal-, possibly bull's-, head handles, and two-tiered elongated bosses (London 1976, p.167, no.174; Torres Balbás 1973, p.747, fig.587). A similar one, 15 centimetres high with a single plain ring-handle and three-tiered angular bosses, is in the Victoria & Albert Museum, London, inv. no. M51–1952 (Melikian-Chirvani 1982, p.159, no.67, where it is catalogued as from western Iran; see Allan 1986, p.19 for a Fatimid attribution).
7. Gabrieli & Scerrato 1979, p.182, no.205. See also Venice 1993, p.123, cat.no.40.
8. Staatliche Museum, Berlin. It is considerably larger, with a height of 13 centimetres; see Pope 1938–9, VI, pl.1280a. It is undated but Pope tentatively attributed it the 10th or 11th centuries.
9. Science Museum, London, inv. no. A643450: height 8 centimetres, rim diameter 11.3 centimetres, base diameter 8.7 centimetres (unpublished); Kunsthaus Lempertz, Cologne (Launert 1990, p.173, no.178, catalogued as 12th- to 13th-century Spanish-Moorish); and Victoria & Albert Museum, London, inv. no.M17-1938, height 8.7 centimetres, rim diameter 11.2 centimetres, base diameter 9 centimetres (Lewis 1984, pl.xliii, no.7).

174, 175
Two cylindrical mortars
Spain, perhaps 13th–14th centuries

height 10 cm
diameter 11 cm (approximate)
capacity 540 cc (approximate)
weight 3.85 kg
material bronze
accession no. MTW1311

height 9 cm *diameter* 10.3 cm
capacity 330 cc (approximate)
weight 3.45kg
material bronze
accession no. MTW1312

Cat.174 is a small, rimless mortar with a cylindrical body with ten elongated lancet-shaped bosses that alternate in orientation. There are five bosses on either side of two square handles, which have slight notches at the outer edges and attached rings. There is a casting flaw at the upper edge of the mortar, and the bottom interior surface is distinctly ovoid and smooth, with a maximum depth of 9.8 centimetres. Quite similar examples are to be found in the British Museum and a private collection of unknown location.[1]

Cat.175 also has a cylindrical body, this time with a slightly flaring rim, and 14 severely tapered and elongated lancet-shaped bosses, alternating in orientation, seven on either side of the two handles. The tops of the handles are angled slightly upwards and have a deep notch near the body of the mortar, in addition to other slight notches and ridges. The walls are thick and the inside lower surface gently ovoid, with a maximum depth of 7.4 centimetres.

This mortar is quite similar to examples in several British collections,[2] as well as one now in Cologne, which has been catalogued as early 15th-century Italian.[3]

1. British Museum, London, Department of Oriental Antiquities, inv. no.1907.11–9.5 (height 7.4 cm, rim diameter 8.8 cm); Lewis 1984, no.6. Another, sold at Sotheby's in Amsterdam, is 9 centimetres high; Launert 1990 p.175, no.182, catalogued as early 16th-century Italian.
2. Fitzwilliam Museum, Cambridge, inv. no.M.23–179 (height 8.5 cm, rim diameter 9.5 cm); British Museum, London, Department of Oriental Antiquities, inv. no. 1907.11–9.6 (height 9.5 cm, rim diameter 11.3 cm); Victoria & Albert Museum, London, inv. no.M.16–1938 (height 8.2, rim diameter 9.3); Ashmolean Museum, Oxford, inv. no.1952–182 (height 9.1 cm, rim diameter 10 cm); see Lewis 1984, pl.xlii, nos 2, 4 and 5 and p.327, fig.1.3.
3. Kunstgewerbemuseum, Cologne (height 9 cm, rim diameter 10 cm); see Launert 1990, p.174, no.180.

174

175

Type 2. Syro–Egyptian mortars, 11th–12th centuries

This group presents a cylindrical, straight-sided body with a slightly flared rim and no handles. It is sparsely decorated with two rows of large, almond-shaped bosses, alternating in orientation and staggered in placement. Previously published examples of this style have been attributed to Khurasan, with dates ranging from the 11th to the 13th centuries.[1] This attribution was probably made because, until quite recently, virtually all Middle Eastern metal mortars were attributed to Iran and because later, highly decorated mortars of a similar shape display characteristics associated with other Khurasani metalwork.[2]

The five examples in the Khalili Collection are sufficiently different from those more certainly attributable to Iran as to suggest another, and perhaps earlier, place of production, possibly Syria or Egypt in the 11th or 12th centuries. The body shape is identical to a large mortar now in Palermo,[3] though Type 2 mortars lack handles and have almond-shaped bosses rather than lancet-shaped fins. The decorative band of scrolling stem on cat.176 is very similar to that on a concave-sided copper alloy bowl attributed to Fatimid Egypt,[4] and also to that on one of the mortars found in a shipwreck off the Algerian coast, though the frame of dots is omitted, while the upper band of decoration on cat.179 is much like that on another item from the Algerian cache.[5] The herringbone bands on cat.181 and 183 reflect similar patterns on yet another of the mortars from the shipwreck, but with the ground left blank.[6] Thus, Type 2 mortars share a body shape and decorative patterns strikingly similar to those of Fatimid metalwork and to certain Andalusian or North African mortars that may perhaps be dated to the 11th or 12th centuries. On the other hand, they display a prominent use of teardrop-shaped bosses, and, except for cat.183, have no handles at all.

Fatimid products not infrequently drew on classical Roman and Byzantine designs, and the almond-shaped bosses, also sometimes called cabochon or lotus or teardrop, are a feature of Roman mould-blown glass of a type datable to the 1st century AD and found all over the Roman world, including Syria.[7] Early Syrian glass-making techniques practised under Roman rule could well have influenced the later Islamic Syrian metalworkers.[8] The ornamental use of large, almond-shaped bosses also extended into Iran, probably via the late Roman and Byzantine trade routes, where they became a common feature on base-metal flasks dating from the 10th to 12th centuries,[9] and on mortars.

One of the Type 2 mortars in the Khalili Collection, cat.181, has a name engraved in Kufic, reading *al-Shaykh al-Faqīh Abū'l-Faḍl Muḥammad ibn Isḥāq*. This name is probably that of an owner rather than a maker and contains no elements inconsistent with being a Syro–Egyptian product. Cat.183 is unusual in being the only example recorded of a baseless cylindrical mortar with slightly flaring rim that also has a lug-handle. In this case, however, the handles are not the larger type associated with eastern products but are small almond-shaped bosses perforated so as to hold a ring. The lug-handles, in fact, have a striking similarity to those on the larger Spanish-Islamic mortar now in Berlin. This mortar is also unusual in that all the bosses point upwards.[10]

The attribution of Type 2 mortars to Syria or Egypt in the 11th and 12th centuries raises the question of their relationship with Mamluk mortars. Unfortunately, little is known about the design of these. During the underwater excavation of shipwrecks off the Megadim coast (west of Mount Carmel, Israel) ten mortars and nine pestles were found amongst a cargo that included coins from the reign of the Mamluk ruler al-Nasir Nasir al-Din Faraj (r. 1399–1412).[11] The latest dated coin was minted in 1404, and it is thought that the vessel sank shortly thereafter. All but one of the mortars, now badly corroded, are, however, of a quite different shape from those in Type 2; that is, they are octagonal with flaring rims and bases, and have one or two animal-head handles with large ring lugs. On one of these mortars, there are single almond-shaped bosses on each face; the other mortars have no bosses. A mortar similar in form to those without bosses found in the shipwreck has been attributed to the Jazirah in the 15th century, though its silver-inlaid benedictory inscriptions have features suggestive of a Mamluk provenance.[12] The Megadim mortars thus relate to those in Type 3, discussed below.

It is worth noting that in the collection of the late E. Saville Peck of Cambridge there were five mortars said to be from Mamluk Egypt, four of which carried inscriptions in the name of Mamluk sultans: al-Malik al-'Adil Qala'un (r. 1280–1290);[13] al-Malik al-'Adil al-Nasir Hasan ibn Muhammad, presumably al-Nasir Muhammad (r. 1347–1354);[14] Qa'it Bay (r. 1468–1496);[15] and al-Malik al-'Adil [al-Ashraf Qansuh] al-Ghawri (r. 1501–1516).[16] The last also bears a date, AH 865 (AD 1460–61). There is clearly a discrepancy between the date on this last mortar and the dedication; what is more, the shape and nature of the metalwork is characteristic of European workshops, and is otherwise unattested amongst Islamic products. The shape of the mortar in the name of al-Nasir Muhammad is identical to the globular and truncated pear-shaped, handleless mortars with fins around the middle that are still being produced today.[17] A fifth mortar in the same collection bears no inscription or date, and is also of a form – a low cylindrical body with six small projections or fins – that is still being produced today.[18] If the inscriptions could be regarded as genuine, this group would be of great importance, spanning three centuries from the late 13th to the early 16th, but the shapes of three of them are European and the silver-inlay work looks late 19th-century in date. Although a final assessment should wait until the group can be examined in detail, it seems unlikely that they will prove to be genuine, and thus serve to fill a gap in our knowledge about the development of the mortar in Mamluk Egypt and Syria.

1. Staatliche Museum, Berlin (Pope 1938–9, VI, pl.1280B); Musée des arts décoratifs, Paris (Melikian-Chirvani 1973, pp.18–19); and Kuhnke Collection, Munich (Launert 1990, p.95, pl.50).
2. For example, State Hermitage Museum, St Petersburg, inv. no.CA-12711 (London 1976, p.171, cat.no.181) and Muzim-i Rawza, Ghazni (Melikian-Chirvani 1982, p.67). James Allan (1976, pp.649–51) lists eight in this general category of handleless cylindrical shape with flared rim. Cat.183 was described in the catalogue of an auction at Sotheby's, London, 15–16 October 1985 (lot no.46) as a Persian mortar of the 10–12th centuries.
3. Gabrieli & Scerrato 1979, p.182, no.205.
4. Coptic Museum, Cairo, inv. no.5919, illustrated in Allan 1985, p.129, figs 1 and 2.
5. Golvin 1962, pp.244–5, no.1 and pp.248–9, no.3, respectively.
6. Golvin 1962, pp.246–7, no.2.
7. For one from Syria, see British Museum, London, Department of Graeco-Roman Antiquities, inv. no.1913.5–22.18 (illustrated in Harden, Pinder-Wilson & Tait 1968, no.62); for other examples, see Bergman & Oliver 1980, no.65.
8. See Rogers 1977, pp.241–2.
9. See Allan 1986, pp.120–21; Ward 1993, p.61.
10. For the mortar in the Staatliche Museum, Berlin, see Pope 1938–9, VI, pl.1280A. The four bosses on a handleless mortar in the British Museum, London, Department of Oriental Antiquities, inv. no.1939.X–18.1, which is otherwise of similar shape and dec-

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oration to those found off the Algerian coast, also point upwards; see Barrett 1949, pl.2B.
11. The mortars and pestles are now in the Israel Museum. See Jerusalem 1985, pp.17–22.
12. Now in the Aron Collection; see Allan 1986, pp.140–41.
13. Saville Peck 1932, p.31, pl.v, fig.17 (right).
14. Saville Peck 1932, p.31, pl.v, fig.19; also illustrated in Gunther 1937, no.258, fig.1, opposite p.335.
15. Saville Peck 1932, p.32, pl.v, fig.20; Saville Peck 1952, p.893, fig.12.
16. Saville Peck 1932, p.31, pl.v, fig.17 (left). The four mortars bearing sultans' names are listed in Konig 1975, p.12.
17. There are many unprovenanced examples of this type; see, for example, British Museum, London, Department of Oriental Antiquities, inv. no,1907.11–9.1.and 1907.11–9.4; Fitzwilliam Museum, Cambridge, inv. nos M22–1952 and M5–1955; Musée des arts décoratifs, Paris, inv.no.14679; and Science Museum, London, Wellcome Collection, inv. no.A604711. For a published example, see Melikian-Chirvani 1973, pp.94–5, where dates of the 14th to 16th centuries are tentatively suggested for the objects.
18. Saville Peck 1932, pp.31–2, and pl.v, fig.18. For similarly shaped mortars, see Launert 1990, p.174; Topham 1981, fig.246.

176–184

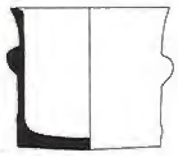
Five cylindrical mortars and four pestles

Egypt or Syria, 11–12th century

176, 177

height 13.1 cm *diameter* 14.5 cm
capacity 1180 cc (approximate)
weight 4.5kg
material brass
accession no. MTW411

length 25.2 cm
diameter 6.5 cm (pounding end)
3.5 cm (central knop) 2.4 cm (shaft)
weight 1.60kg
material brass
accession no. MTW1457



176

The mortar, cat.176, is decorated with twelve bosses in two rows of six. Between each pair are incised triangles which contain leaf-and-stem designs that alternate in orientation and are staggered in placement. Above the base of the vessel is a band of scrolling stems interspersed with blank circles, and on top of the rim four small cartouches with scrolling stems. A corrupt benedictory inscription in Kufic, set in a recessed ground of vegetal design interrupted by four blank diamonds, reads *bi'l-yumn* [...] *wa'l-barakah* ('With good fortune [...] and [God's] blessing').

Cat.177 is a banded pestle with an ovoid head and greatly flared pounding end.

176 with 177

178

height 12.4 cm *diameter* 14.6 cm
capacity 1180 cc *weight* 4.75kg
material brass
accession no. MTW122

Cat.178 is a mortar with nine decorative bosses, five set slightly lower than the others, alternating in orientation, with an engraved palmette issuing from each point. Above the base a band of scrolling stems is framed by double lines. Beneath the rim there is a broad band of Kufic benedictory inscriptions,[1] the letter forms highlighted by the use of a black filler. The mortar has a finished, triangular cast-in repair which appears to be contemporary with manufacture, perhaps to fill in some porosity; it may be contrasted with the cast-in repair on cat.196.

1. They read *barakah wa yumn [wa] surūr wa saʿādah wa salāmah wa karāmah wa naṣr wa … wa* ('Blessing, and good fortune, and joy, and happiness, and well-being, and generosity, and victory, and … and').

179, 180

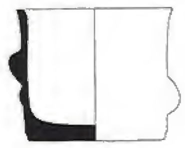
height 9.8 cm *diameter* 11.5 cm
capacity 600 cc (approximate)
weight 2.10kg
material brass
accession no. MTW120

length 18.1 cm
diameter 3 cm (pounding end)
1.4 (shaft)
weight 0.30kg
material brass
accession no. MTW1452

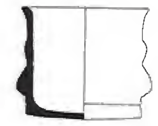
The mortar, cat.179, also has twelve bosses in two rows of six, alternating in orientation and staggered in placement. Each boss is two-tiered and an engraved palmette issues from each point. Above the base there is a slight indentation, engraved with a band of strapwork consisting of three parallel strands linked to form a periodic guilloche. Beneath the rim, between double lines, is a meander bearing three-lobed leaves.

The banded pestle, cat.180, has a flared pounding end. The handle is engraved with diagonal bands, while the knob-like handle is incised with eight deep grooves to form a rosette.

180



178



179

181

183

178

179 with 180

181, 182

height 16.5 cm *diameter* 16.4 cm
capacity 2200 cc (approximate)
weight 7.60kg
material brass
accession no. MTW626

length 23.3 cm
diameter 5.5 cm (pounding end)
2 cm (middle of shaft)
weight 1.15kg
material brass
accession no. MTW 1453

The mortar, cat.181, has eight almond-shaped bosses, alternating in orientation, and arranged in two rows of four. Near the points of the lower bosses there are traces of an incised 'eternal knot' inscribed in a circle. A narrow area above the base is slightly indented and decorated with a band of herring-bone strapwork. Beneath the rim is a broader band, now quite worn, formed of s-shaped curves. Near the middle of the vessel a Kufic inscription gives a name, presumably that of a previous owner, *al-shaykh al-faqih Abū al-Faḍl Muḥammad ibn Ishaq*. Cat.182 is an unbanded pestle with an angular head and flared pounding end.

183, 184

height 8.1 cm *diameter* 10.3 cm
capacity 450 cc (approximate)
weight 1.55kg
material bronze
accession no. MTW123
published Sotheby's, London, 15–16 October 1985, lot no.46

length 14.1 cm
diameter 3.6 cm (pounding end)
1.8 cm (middle of shaft)
weight 0.35kg
material bronze
accession no. MTW1456

The mortar, cat.183, has four double-tiered almond-shaped bosses of somewhat angular form, all oriented with the point upwards. Interspersed are four smaller almond-shaped bosses, each pierced to hold a ring. The ring-handles are missing, except for one which is intact and made of twisted wire of heavy gauge and square in section. A narrow area above the base is slightly indented and filled with a zigzag pattern. Beneath the rim is a band formed of two narrow parallel lines above which there is an engraved design of Kufic lettering, possibly reading *li-ṣāḥ[ibihi]* ('To its owner').

Cat.184 is a banded pestle with a spherical head and flared pounding end. The band has widely spaced, deep, diagonal grooves.

182

184

181 with 182

183 with 184

Type 3. Mortars from Anatolia and the Jazirah, 12th to 14th centuries

The mortars in this group are octagonal in form and probably date from the late 12th to the late 14th century. Preliminary indications suggest that they may have been produced in Anatolia or the Jazirah.

The most distinctive example of the type in the Collection is cat.187, which is sharply angular, with a clearly defined octagonal body and a rim and base that are wide and flat and joined to the body by a 45-degree chamfer. The body has engraved arcading, in the form of pairs of spandrels filled with scrollwork flanking the single boss on each face. The bosses all point in one direction, towards the rim, which is a feature apparently unique to this group. The two handles take the form of a lion's head, while that on cat.188 is shaped like a bull's head. Huge rings are inserted in the handle. Although there is no decoration visible on cat.188, its general form relates it to cat.187

Cat.185 differs somewhat in that its shape is less aggressively octagonal, and the rim and base are not linked to the body by such an angled chamfer, but its three surviving handles each have two holes for rings, like those on cat.187, and it too has a single boss in the centre of four sides, flanked by decorative arcading. Both mortars have pseudo-inscriptions in, alternately, Kufic and *thulth* script on a ground of scrolling stems.

Cat.189 is perhaps the earliest of the four representatives of this group in the Khalili Collection, and is the least distinctly octagonal. The seven faces without handles carry not one almond boss but three, alternating with single two-tiered almond bosses. Groups of three bosses also appear on cat.188.

Several octagonal mortars with sharp bevels leading to wide, flat rims and bases appear to be of Anatolian provenance.[1] A similar, though simplified, form of arcading is found on the faces of two octagonal mortars now in Istanbul that are said to come from Diyarbakır, which also have well-preserved bull's-head handles.[2]

How widespread the type was in Syria and the Jazirah is, at present, uncertain, but a mortar of comparable form has been attributed to the Jazirah and related mortars were found in a Mamluk-period shipwreck found off the Megadim coast, near Mount Carmel, Israel (see above, p.291). It is worth noting that two of the examples in the Collection, cat.187 and cat.188 have corrosion caused by long exposure to sea-water.

1. Koçabaş Collection (Erginsoy 1978, p.427, nos 204, 205); Museum of Turkish & Islamic Arts, Istanbul, inv. no.1512 (Erginsoy 1978, p.424, no.201, and Istanbul 1983, no.D 110).
2. Museum of Turkish & Islamic Arts, Istanbul, nos 1509 and 1510 (Istanbul 1983, pp.64, 65, nos D108 and D109; and Erginsoy 1978, pp.421 and 423, nos 199 and 200). Five other known octagonal mortars have bull's-head handles of approximately the same proportions as those on cat.188, but with large curved horns: Victoria & Albert Museum, London, inv. no. M.24–1963 (Melikian-Chirvani 1982, pp.161–3); Museum of Turkish & Islamic Arts, Istanbul, inv. nos 1509 and 1510 (Erginsoy 1978, pp.421, 423, nos 199 and 200); Metropolitan Museum of Art, New York (Pope 1938–9, VI, pl.1279A); Sotheby's, London, 20 October 1994, lot no.52. But compare the almost feline head on Victoria & Albert Museum, London, inv. no.466–1876 (Melikian-Chirvani 1982, pp.160–61).

185–190

Four octagonal mortars and two pestles

Anatolia or the Jazirah,
12th to 14th centuries

185, 186

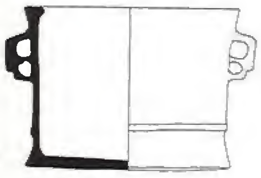
height 14.5 cm *diameter* 20 cm
capacity 2580 cc (approximate)
weight 8.95kg
material brass
accession no. MTW793

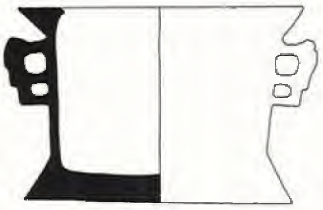
length 25.5 cm
diameter 4.5 cm (pounding end)
2.1 cm (middle of shaft)
weight 1.05kg
material brass
accession no. 1454

Four faces of the mortar originally bore an animal-head handle with holes for two rings, now missing; one of the handles has been lost. The kind of animal intended is not clear, though they were probably meant to be lions. On the other four sides of the mortar, alternating with the handles, there are single, almond-shaped bosses. Around each handle and boss is an arcade of scrolling stems enclosed within a braided frame. This design is very similar to that on cat.187. Beneath each handle is an engraved decorative device formed of a crescent moon and leafy stems, and beneath each boss an abstract pattern, perhaps imitating a script. The underside of the rim is decorated with eight cartouches of tightly scrolling vines; the top of the rim is blank. A thick, single torus moulding separates the body from the slightly flaring foot, which has four cartouches of what are largely pseudo-inscriptions in Kufic (beginning *al-'izz*, 'Glory') against a vegetal ground, alternating with cursive inscriptions on a hatched ground, none of which is decipherable.

Cat.186 is an unbanded pestle with a flattened rounded head and a slightly flared pounding end.

186





187

height 12.5 cm *diameter* 20.3 cm
capacity 1770 cc (approximate)
weight 10.45kg
material brass, now encrusted with copper salts
accession no. MTW950

Two, opposite sides of cat.187 bear animal-head handles, probably intended for lions, with two rings in each. On the other six faces of the mortar there are two-tiered angular bosses of triangular cross-section. These are flanked by pairs of spandrels filled with incised scrollwork. A single cable separates the body from the rim, the underside of which is decorated with cartouches containing pseudo-Kufic inscriptions on a ground of scrolling stems. The flaring foot is similarly decorated with *thulth* inscriptions, of which only a few letters can be read. The base of the mortar, both inside and out, is quite flat. The top of the rim has some decoration, which is no longer legible. The engraving was inlaid with a black compound which allows the designs to be read, despite the heavy incrustation of copper salts both inside and out.

188

height 16 cm *diameter* 23.3 cm
capacity 350 cc (approximate)
weight 9.90 kg
material brass, heavily corroded
accession no. MTW 127

This octagonal mortar has a group of almond bosses, two elongated and one smaller, all with the same orientation, on seven of its faces. On the eighth face there is a handle in the form of an animal head with what appears to be two horns, which is probably intended as a bull's head. A single plain ring passes through the handle. The flat top of the flaring rim has eight small almond bosses. There appears to be no other decoration or inscription on the mortar, though the green patina of verdigris may be obscuring it.

The flanged base and flared rim are roughly octagonal, for both have been slightly deformed through use. The underside of the mortar bulges outwards, though the inside of the base is fairly flat.

189, 190

height 12.9 cm *diameter* 17.3 cm
capacity 1750 cc (approximate)
weight 6kg
material brass
accession no. MTW 121
provenance Sotheby's, London, 16–17 April 1985, lot no.241

length 21.7 cm
diameter 4.9 cm (pounding end) 2.3 cm (middle of shaft)
weight 1 kg
material brass
accession no. MTW 1451

Cat.189 is so rounded that it gives only a hint of its octagonal shape. The body bulges slightly before turning in above the slightly flaring base, and a single torus moulding separates it from the band of decoration around the rim. Around the body, groups of three almond-shaped bosses alternate with single, two-tiered, bosses, all oriented in the same direction. On one face, in place of a group of three bosses, there is a single loop handle. An engraved ring below the loop handle indicates where a ring might have been put on an earlier or more expensive object.

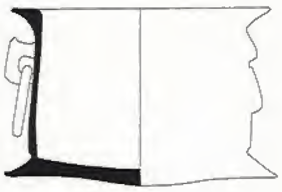
Engraved almond-shaped medallions frame each boss, and the intervening areas are filled with vines bearing palmettes. The flaring base has roundels filled with vegetal motifs interspersed between eight cartouches that contain running animals on grounds of spiralling vines. The band beneath the rim also has roundels of vegetal motifs between eight cartouches with a Kufic inscription, on a ground of curling vines, which are repetitions of the word *al-dawlah* ('Good fortune'). The underside of the mortar has an even and obvious bulge with a crack which is reciprocated on the interior. This may indicate long and hard use.

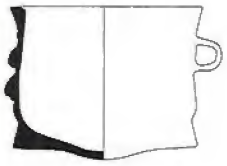
The general shape of this mortar, as well as the design of the incised decoration that frames the bosses and fills the flaring base and the band near the rim, resembles that of a mortar now in the Victoria & Albert Museum, though the latter has only single bosses, and better formed epigraphy.[1]

Cat.190 is a banded pestle with a silver-inlaid guilloche band around the knob-like handle, and a silver-inlaid six-pointed star on top of the handle. The band in the middle of the pestle is incised to look like rope, and the pounding end of the pestle flares rather broadly with a burr around the edge indicating deformation by compression.

1. London, Victoria & Albert Museum, inv. no.M.292–1956; see Melikian-Chirvani 1982, pp.134–5, no.62.

190





Type 4. Mortars from Transoxiana, late 12th to 13th century

This group consists of handleless, bucket-shaped mortars, made in Transoxiana in the late 12th to 13th century. They have a broad, flat rim and a body that bulges slightly before turning in above the flaring base, a shape that is reminiscent of Central-Asian buckets, especially those from Transoxiana in the 13th-century.[1]

One of the examples in the Khalili Collection, cat.191, bears traces of decoration that includes long-necked birds, perhaps harpies, while running dogs and hares set against a ground of tightly scrolling vines – a common decorative motif on north-east Iranian metalwork of the period – are visible in a band on cat.193.

1. See Allan 1986, pp.152–5.

191–193

Two bucket-shaped mortars and a pestle

Transoxiana (?), late 12th to 13th century

191, 192

height 14 cm *diameter* 19.6 cm
capacity 230 cc (approximate)
weight 7.9kg
material brass
accession no. MTW 125

length 24 cm
diameter 4.4 cm (pounding end)
2.2 cm (middle of shaft)
weight 1.15kg
material brass
accession no. MTW 1469

The body of the vessel bears six elongated and flattened almond-shaped bosses, all pointing upwards, with a circular knob above the point. Between the bosses, there are traces of medallions enclosing depictions of harpies against scrolling stems. Because of extensive corrosion, most of the band of benedictory inscriptions in *naskh* script on a ground of scrollwork, set between the small knobs, is now illegible, and only the phrase *bi'l-'izz wa'l-salāmah wa ...* ('with honour and well-being and ...') can be read. A similar band written in Kufic surrounds the lower part of the body and Kufic inscriptions on a ground of scrolling vines fill six cartouches, interspersed with roundels, on the flat part of the rim.

Cat.192 is a banded pestle with a spherical head and flared pounding end.

193

height 12.2 cm *diameter* 17 cm
capacity 1400 cc (approximate)
weight 4.35kg
material brass
accession no. MTW 126

Around the body of this mortar are two rows of almond bosses, four in each row, alternating in orientation. The body is divided into three decorative zones; the central band of wide interlinking chains is filled with S-shaped vines. Between the bosses on the lower row are four cartouches, each enclosing two running animals, apparently hares and hunting dogs, incised on a ground of tight scrolls. Between the bosses in the upper row a four-part benedictory inscription is inscribed in *thulth*, reading 'honour, prosperity, good fortune, happiness, well-being, good health, and long life'.[1] On the flaring base are four cartouches with scrollwork, separated by roundels filled with four small diamonds forming a St Andrew's cross. The flat rim is undecorated. There are two depressed casting flaws on the underside of the mortar.

1. *Al-'izz wa'l-iqbāl wa al-dawlah wa al-sa'ādah wa al-salāmah wa al-'āfiyah wa al-baqā'.*

192

191

193

Type 5. Mortars from Khurasan, late 12th to 13th centuries

Mortars of this type are handleless, cylindrical vessels with flaring rims and bases on a body with a waisted silhouette.

Cat.196 and 194 have grounds of tight scrollwork for decoration and inscriptions, which is typical of Khurasani work, as is the use of raised lozenges between the almond-shaped bosses. The occurrence of animal-head bosses instead of almond shapes on waisted cylindrical mortars, such as cat.194, is, on the other hand, somewhat unusal, though a similar example is now in Berlin.[1]

1. Museum für Islamische Kunst, Berlin, inv. no.I.3558; see Berlin 1986, p.82.

194–196

Two waisted mortars and a pestle

Khurasan, late 12th to early 13th century

194, 195

height 10 cm *diameter* 13.4 cm
capacity 500 cc (approximate)
weight 3.35kg
material brass
accession no. MTW 624

length 19.5 cm
diameter 4.1 cm (pounding end)
2 cm (middle of shaft)
weight 0.65kg
material brass
accession no. MTW 1458

This mortar has a more pronouncedly waisted silhouette than cat.196. It is also highly decorated, with an intricate scrolling vine pattern filling all the bands. On the rim there are three, six-petalled flowers inlaid in copper, and around the centre of the mortar six raised lozenges decorated with vegetal designs. Above and below these are two rows of animal-head bosses, six in each row, with those in the lower row upside-down so as to mirror those in the upper row. One of the heads is missing in the top row, where there is now only a hole.[1] The space between the bosses is covered with strapwork filled with scrolling. On the flaring base, inscribed in Kufic on a ground of scrolling stems, there is a benedictory inscription framed by narrow bands that at three points interrupt the inscription to form eternal knots.[2] Beneath the rim there is a similar benedictory inscription written in *thulth* over scrolling stems and also interrupted at three points by everlasting knots.[3] On the top of the rim, between the copper-inlaid rosettes, there are cartouches containing benedictory inscriptions in Kufic on a ground of scrolling stems.[4] The underside shows signs of hammering, suggesting that the mortar was at one time inverted and used as an anvil.

The pestle has a rounded head with a band immediately beneath it and a knop around the middle of the shaft. The pounding end is gently flared.

1. There are traces of modern soldering which suggests that there may have been a recent attempt to replace the head.
2. *Bi-l-yumm wa-l-barakah wa-l-dawlah bi-l-yumn wa-l-barakah wa-l-dawlah wa-l-[...] wa-l-salāmah wa-l-sa'ādah wa-l-[b]irr* ('With good fortune and blessing and wealth. With good fortune and blessing and wealth and ... well-being and happiness and piety').
3. *Al-'izz al-d ā'im wa-l-baqā wa-[l-...] wa-l-midḥah wa-l-thanā' wa-l-birr wa-l-'aṭā' wa-l-rif'ah* ('Perpetual glory and long life and ... and praise and commendation and piety and charity and high rank').
4. This inscription is all but identical to that on the base.

196

height 12.7 cm *diameter* 14.3 cm
capacity 1160 cc (approximate)
weight 3.85kg
material brass, with silver and copper inlay
accession no. MTW 1354
provenance Sotheby's, London, 10–11 October 1990, lot no.167

This highly decorated mortar was made for an otherwise unknown individual by the name of 'Uthman Hajjaj.[1] It is very slightly waisted, and around the middle are six lozenges, each with an eternal knot motif inlaid in silver, set within a lozenge of copper inlay. Between the raised diamonds there is a floral design inlaid in silver and copper. Two rows of six large almond bosses, with points oriented toward the central band, dominate the mortar. Between the bosses there are cartouches enclosing dogs and hares, inlaid in silver and copper.

Silver-inlaid benedictory inscriptions appear in a narrow band around the slightly flared base, written in Kufic;[2] in a broad band beneath the rim, written in *thulth* on a ground of tightly scrolling vines;[3] and on the top of the rim itself, where there is a four-part Kufic inscription.[4] The name of the patron or dedicatee is inlaid in silver in *naskh* script in an otherwise empty narrow band immediately beneath the broad cursive benedictions.

Rather unusually, the underside is also decorated with an engraved ring of scrollwork, now quite worn. A sharply raised area in the middle of the base appears to be a later cast-in repair.

1. See Volume XI of this catalogue for further discussion of this object.
2. *Bi'l-yumn wa'l-barakah wa'l dawlah wa'l-salāmah wa'l-sa'ādah wa'l-shukrah wa'l-shifā'ah wa'l-shāfa'ah wa'l-nuṣrah wa'l-rāfah wa'l-raḥmah wa'l-rāḥah wa'l-baqā' li-ṣā[ḥibihi]* ('With prosperity, divine grace, good fortune, well-being, happiness, thankfulness, gratitude, advocacy, intercession, assistance, compassion, mercy, repose and long-life to its owner').
3. *Al-'izz wa'l baqā' wa'l-ḥamd wa'l thana' wa al-rif'ah wa'l-'alā' wa'l-*
wa al-'ṭā wa'l-luṭf wa'l-riḍā
wa'l-wafā li-ṣāḥibihi a
('Honour, long-life
dation, high-rank
piety, generosity
contentment, le
its owner foreve
4. *Bi'l-yumn wa*
da[wlah] ('With
grace, good fort

195

194

196 with 195

Type 6. Mortars from Khurasan, 13th century

Cat.197 is of a distinctive octagonal form attributed to Khurasan, with a wide, flaring rim and flat base. Three other recorded octagonal and handleless mortars attributable to Khurasan have, like cat.197, a body divided into three decorative zones, the lower one of which bears bands of running animals, usually hares.[1] In these comparative examples, however, the upper zones consist of a wide band of benedictory inscriptions in Kufic with a central band formed of a narrow rope design framed by cables. Large engraved central medallions like those on cat.197 are a decorative feature of three other recorded mortars of the same general body shape that are also attributable to the later Khurasani school;[2] on these, however, the base and rim are not as wide and are joined to the body by a 45-degree chamfer. On one of them the medallions contain human-faced birds with wings and two large tail feathers very similar to those of the bird-like creatures on cat.197, which nevertheless lack human faces and seem to have more than two legs. A fourth mortar of this type, with a 45-degree chamfer leading to a wide base and rim is probably an earlier example of the form.[3] By comparing cat.197 with these seven other mortars it can be seen that the Khalili example represents a blend of several decorative traditions in mortar production current in Khurasan in the 12th or 13th century.

The faceted shape of cat.197 and the related examples, with wide flaring rim and base, is strikingly similar to that of bowl-stands that were produced in Khurasan in the 12th and 13th centuries.[4] Running animals and eternal knots are also frequently a part of the decorative patterns on such trays.

1. Deutschen Apotheken-Museum, Heidelberg, Collection of the Wartenberg Foundation (illustrated in Hein & Müller-Jahncke, pp.16–17, where it is attributed to western Persia and the 12th century); Los Angeles County Art Museum, inv. no.M.73.5.264a (illustrated in Savage-Smith 1993, p.224); and Sotheby's, London, 25 April 1990, lot no.89.
2. Victoria & Albert Museum, London, inv. no.M.111–1929, which has human-faced birds in the medallions (Melikian-Chirvani 1982, pp.110–11, no.42); Kuhnke Collection, Munich, closely resembling the Victoria & Albert Museum example in every respect except the design of the large medallions, which does not appear to contain a bird (illustrated in Launert 1990, p. 99); and one in the Herat Museum, which has a quite different medallion on seven of its faces and a handle on the eighth (Melikian-Chirvani 1982, p. 68, fig.38).
3. It has large silver-inlaid eternal knots alternating on the faces with runnng hares, and on the base there are inlaid lunar crescents interrupting the benedictory inscriptions. Rijkmuseum, Amsterdam, inv. no.118115 (illustrated in Konig 1973, p.13).
4. For examples, see two in the Victoria & Albert Museum, London, inv. nos 1436–1902 and 1439–1902; Melikian-Chirvani 1982, pp.89–92.

197, 198

Octagonal mortar and pestle
Khurasan, 12th to 13th centuries

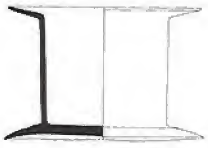
height 14.8 cm *diameter* 23.2 cm
capacity 1740 cc (approximate)
weight 7.45kg
material brass
accession no. MTW 1070

length 23.2 cm
diameter 5.4 (pounding end)
1.8 cm (near band)
weight 1.15kg
material bronze
accession no. MTW 1455

In an upper band of Kufic on the octagonal body of the mortar, only the word *barakah* ('blessing') is readable. This inscription has a ground of crude scrollwork. The central band consists of large medallions containing birds, one on each face of the mortar, and the lower band carries the figures of dogs pursuing hares. The flanged, eight-sided base has a band of pseudo-Kufic. All three bands have a similar ground to the Kufic inscription. The upper surface of the flat rim has a cursive inscription, only partially readable, on a ground of scrolling stems interspersed with eight roundels filled with vegetal design.

Cat.198 is an undecorated, banded pestle with a knob-like handle.

198



197 with 198

Type 7. Later Khurasani mortars

Mortars of this type are probably eastern Iranian products of the 14th or 15th centuries. Cat.199 and cat.201 are cylindrical handleless mortars with torus mouldings separating the body of the mortar into panels. Both mortars are also decorated with silver inlaid designs that include eternal knots. Inlaid crescent moons, a feature of cat.201, also occur on three other recorded cylindrical mortars from Khurasan with torus mouldings.[1]

The poorly formed inscriptions on the mortars in Type 7 suggest that they were copied from earlier examples. The decoration and epigraphic features of this group, while suggesting a late eastern origin, do not provide sufficient clues to determine precisely where and when they were produced.

1. Kabul Museum (Melikian-Chirvani 1982, p.68, figs 37 and 38); Victoria & Albert Museum, London, inv. no.M.948–1886, with copper inlaid crescents (Melikian-Chirvani 1982, pp.109–10, no.40); and Christie's, London, 19 October 1993, lot no.306. They also occur on a Type 6 mortar produced earlier in Khurasan (see Konig 1973, p.13).

199–201

Two cylindrical mortars and a pestle

199, 200

Eastern Iran, 14th century
height 12.5 cm *diameter* 15.2 cm
capacity 1000 cc (approximate)
weight 3.80kg
material brass with silver inlay
accession no. MTW 1436

length 22.3 cm
diameter 5.6 cm (pounding end)
2.1 cm (near band)
weight 1.10 kg
material brass with silver inlay
accession no. MTW 688

The mortar has a double-torus moulding around the waist, between two broad bands of silver-inlaid inscriptions on scrollwork grounds. These pseudo-inscriptions are written in *thulth* and are arranged in three parts on each band, with each part separated by a silver-inlaid eternal knot. A triple-torus moulding divides the lower inscription band from the flaring undecorated base. The top of the thick and flaring rim is decorated with a silver-inlaid meander.

The cursive inscription here is strikingly similar to a silver inlaid inscription on a cylindrical mortar now in a private collection in Germany, which also has virtually identical decoration on a recessed band above the base.[1] There are, however, differences, for the German mortar lacks the torus mouldings and has triangular bosses where cat.199 has inlaid everlasting knots.

Cat.200 is a pestle with a central knop inlaid in silver with a guilloche band. The lower section of the shaft is eight-sided; four of the faces bear engraved cartouches containing scrolling leaves, the remaining four bear silver-inlaid guilloche bands. The bottom of the pestle flares broadly and immediately above it is an engraved benedictory inscription in *naskh* on a ground of scrollwork.[2] The handle of the pestle is engraved with diagonal bands, while the knob at the head has eight deeply incised grooves, forming a rosette. The bottom of the pestle has a high burr around its flaring edge indicating that it has been deformed by compression through long use.

1. Kuhnke Collection, Munich (illustrated in Launert 1990, p.100).
2. *Al-ʿizz wa'l-iqbāl wa'l-dawlah wa'l-saʿādah wa'l-salā[mah]* ('Glory and prosperity and good fortune and happiness and well-being').

201

height 14.8 cm *diameter* 20.6 cm
capacity 1720 cc (approximate)
weight 6.99kg
material brass
accession no. MTW 848

This mortar has an angular foot and flared rim, with an irregular torus moulding separating the body into two unequal parts. The lower part is decorated with six silver-inlaid cartouches, filled with scrolling stems, flowing into eternal knots between the cartouches. The upper panel is decorated with a silver-inlaid and nielloed undulating band containing a guilloche, above which eternal knots alternate with pointed arch-shaped medallions filled with interlaced vines around a silver crescent moon, with another silver crescent moon above. The angled circular base has six cartouches, outlined in silver, filled with pseudo-Kufic inscriptions on grounds of scrolling stems, alternating with roundels filled with seven silver-inlaid stars. The top of the angled rim has a similar decoration of six cartouches of inlaid pseudo-Kufic inscriptions also alternating with roundels of seven silver dots, with an inner ring of scrolling stems alternating with everlasting knots. The underside of the rim is blank. The mortar has a rather large crack on one side, below the torus moulding, and casting porosity on the underside of the base.

200

199

201

Two mortars of unusual design

Two mortars in the Khalili Collection, cat.202 and cat.203, are of quite unusual design in terms of recorded Islamic mortars, yet they retain elements that link them with earlier Islamic products. Both are octagonal – a feature that is generally associated with eastern Islamic mortars. Cat.202 has small, almond-shaped bosses and a large, symetrically flaring base and rim, both of which roll inward towards the body of the vessel. The mortar is unusally shallow, and the black lacquered patina of the exterior, together with the relatively clean line, suggests a European influence. No similar Islamic examples are recorded.

The second mortar, cat.203, is also octagonal, but its form is similar to the Anatolian mortars of Type 3, with their flat rims and bases joined to the octagonal body by a 45-degree chamfer (see cat.187). The decoration of cat.203, however, is very different. The indentations on the handle, reminiscent of an animal-head, are very similar to those on the early Spanish-Islamic mortars. The lion's head, cast in low-relief in place of a boss on seven of its faces, is not unlike the lion's-head bosses found on 16th-century Spanish mortars whose shape and decoration are otherwise very dissimilar.[1] A more elongated lion's head than those on cat.203, which might also be interpreted as the bearded head of a fierce man with bushy eyebrows and bulbous nose, occurs on two flowerpot shaped mortars with slightly flaring rims and four thin, elongated flanges on the body.[2] Both of these mortars have four such heads alternating with the four flanges. The flowerpot shape of the two mortars, admittedly very different from that of cat.203, suggests a European influence and the nature of the epigraphy and metalwork suggests they are Turkish products. On one of them there is a *naskh* inscription giving the name Hajj Yasin ibn Hajj Mustafa, presumably that of an owner.

Octagonal mortars apparently produced in Anatolia do occasionally have raised designs other than almond-shaped bosses. Animals resembling horses, cast in low relief, appear on an octagonal example said to have come from Diyarbakır.[3] Other octagonal mortars assigned to Anatolia during the 11th to 13th centuries have rosettes cast in low relief or abstract designs that are either sickle-shaped or resemble in outline the designs on the two flowerpot shaped mortars.[4] Three ten-sided mortars attributed to Anatolia also have low-relief rosettes on their sides.[5] Yet while it is evident that there was considerable variation and novelty in the design of cast relief decoration on Anatolian mortars, the lions' heads on cat.203 have no obvious parallel, and the proportions of the rim and base to the body differ from those on the Anatolian mortars carrying the low-relief decorations.

For all of these items – cat.203, the two flowerpot shaped examples with the lion's-head bosses, as well as cat.202 – a Sicilian origin from any time between the 15th and 18th centuries could also reasonably be postulated, and other locales are possible, such as Italy, where an itinerant metal-worker from an Arabic or Persian speaking area might settle. Little attention has been given to the products of itinerant artisans moving between the Islamic world and Europe, in circumstances where decorative motifs, as well as casting methods, might blend two or more traditions. The Science Museum in London has in its collections two items that provide some evidence of such movement. One is a mortar that is strictly European in its tankard shape but is engraved with large, undeciphered Kufic inscriptions on a ground of twisted vines.[6] The second is also European in shape, for it has a chalice-like body with a squat stem and two small loop handles, though the sides of the vessel are octagonal, which might indicate an Islamic influence. It bears an Arabic inscription with white infilling that says 'it was bequeathed [*qad waqafa*] to Husayn Thuwaybat Muhammad Jafih [in the year] 1320 [1902–3].' In this case it is evident that a mortar greatly influenced by European design, if not actually made in Europe, came quite recently into the possession of an Arabic speaker, perhaps a druggist.[7]

It is difficult to interpret the influences and cross-currents represented by these two unusual mortars, and, until further evidence comes to light, the time and place of their production must remain conjectural. Nevertheless, they might be interpreted as yielding evidence that Middle Eastern artisans migrated to parts of Europe around the Mediterranean, or that craftsmen working in the Muslim world were influenced by European trends in pharmaceutical equipment.

1. For example, the 16th-century Spanish mortar, sold in Cologne, Kunsthaus Lempertz (see Launert 1990, p.180, no.192). For a 16th-century Spanish mortar with a similar head, interpreted as the head of Medusa, repeated between four flanges, see Urdang 1940, no.369.
2. London, Science Museum, Wellcome Collection, inv. no.A604543 (unpublished), which has an owner's name engraved in *naskh* script and an English label neatly painted on the rim reading 'From Alexandretta, Asia Minor [= Iskenderun, Turkey], believed to have originally come from Sicily'. The second example is in the Topkapı Palace Museum, Istanbul, inv. no.25/3485 (illustrated in Erginsoy 1978, p.425, no.202; and Istanbul 1983, p.62, no.D.103, where the decoration is tentatively described as double-headed eagles).
3. Ankara, Ethnographic Museum, inv. no.11533 (Erginsoy 1978, p.419, no.197; Istanbul 1983, p.62, no.D.101).
4. Istanbul, Topkapı Palace Museum, inv. no.25/3487 (Erginsoy 1978, p.426, no.203); Istanbul, Kayabek Collection (Bodur 1987, p.89, no.A17); and Ankara, Ethnographic Museum, inv.no.15167 (Erginsoy 1978, p.420, no.198).
5. Istanbul, Kocabaş Collection (Erginsoy 1978, p.429 nos 208 and 209, and Istanbul 1983, p. 53 no.D.105); Istanbul, Sadberk Hanım Museum, inv. no.76–3679 (Bodur 1987, p.89, no.A16).
6. London, Science Museum, Wellcome Collection inv. no.A42008 (unpublished); it came to the museum with a note attached saying that it was made by an Arab worker in Venice; purchased at Sotheby's, London, 26 June 1925, lot no.24.
7. London, Science Museum, Wellcome Collection, inv. no.A45088; it was purchased from Stevens in London on 2 October 1925, lot no.2; the surface of the mortar is very scraped and rubbed.

202

Octagonal two-handled mortar

Provenance and date unknown

height 10.8 cm *diameter* 18.6 cm
capacity 1460 cc (approximate)
weight 55.60kg
material bronze
accession no. MTW 124

Two square, pierced handles, the rings of which are now missing, are attached to opposite faces of this octagonal mortar. Each of the six remaining sides has a small, almond-shaped boss, all of which have the same orientation. Separating the body from the rim and foot are irregularly formed single torus mouldings. The outer edge of the broad foot is turned upwards, while the edge of the equally broad rim is turned slightly downwards. The rounded underside of the mortar is covered with hammer marks, suggesting that it was inverted and used as an anvil; the bottom of the interior is concave. This secondary use helps to account for the spreading and high burr at the edge of the broad foot.

The exterior of the mortar is coated with a kind of dark lacquer, reminiscent of European products.

203

Octagonal mortar

Provenance and date unknown

height 10 cm *diameter* 13.3 cm
capacity 700 cc (approximate)
weight 3.20kg
material bronze
accession no. MTW 1074

A single handle with an abstract lion's head is attached to one side of the mortar. Each of the other seven faces is decorated with a boss in the form of a lion's head in low-relief, characterized by large eyebrows and nose, round ears, and fur indicated by dots. Single torus mouldings separate the body of the mortar from the foot and rim, which angle off symmetrically from the body.

202

203

Beekeeping

by Emilie Savage-Smith

Talismanic design for releasing bees from their hives, from a treatise on the magical uses of the names of God written by al-Buni, the foremost authority on the occult (d. AD 1225), cat.22, folio 79b. The text for this diagram is at the bottom of folio 79a.

Bees were highly regarded in Islam not just as a source of honey and of a versatile wax that was an important export to Europe from the 13th century onwards, but also because they were singled out for mention in the Qur'an, in the surah *al-Naḥl* ('The bee'; XVI, verses 68–9): 'And thy Lord taught the Bee to build its cells in hills, on trees, and in (men's) habitations; then to eat of all the produce (of the earth), and find with skill the spacious paths of its Lord: there issues from within their bodies a drink of varying colours, wherein is healing for men: verily in this is a sign for those who give thought.' On the basis of these verses and of *ḥadīth* such as, 'For you there are two remedies, the Qur'an and honey', the latter sub-

22, detail of folio 79b

stance was given an important role in Prophetic medicine (see Part One, p.29 and cat.11). The Prophet awarded bees a special place among flying insects, 'Every fly is destined for hellfire, except the bee', and he interpreted their humming as the repetition of the *ṣalawāt*, the blessing formula given in the surah *al-Sajdah* (XXXII, verse 56).[1]

The exploitation of bees in a systematic manner required the construction of hives, and a cylindrical type made to be laid horizontally was familiar to Roman writers such as Varro and Columella. It is evident from cat.206 that the form was continued in Iran until relatively recent times. In lands where trees were scarce, such hives were made of a variety of materials such as cane or vine, and in Azerbaijan, Luristan, Hamadan and Kurdistan wattle and daub were employed.[2]

The hives were stacked horizontally in rows, with the fronts all facing the same direction, and mud and straw were packed around them for protection from the winter weather. The front of each hive was recessed, probably to provide additional shelter from the snow, and sealed with a ceramic cover. The honey was harvested from the other end of the hive, which was closed with a wooden or wattle cover. Smoke was used to drive the bees to the front of the hive while the horizontal combs were cut from the sides.[3]

The art of beekeeping was thought to be aided by the application of talismanic designs to the beehive covers. Manuals of magic, such as those composed by al-Buni (d. 1225), included talismanic designs for use in beekeeping, although the exact design specified by al-Buni in cat.22, for example, has not been found on any recorded example.[4]

1. Schimmel 1985, p.377.
2. Similar cylindrical beehives, hollowed out of date palm trunks, are used in the Jabal al-Akhdar in central Oman, while terracotta cylindrical hives are still in use in parts of the Yemen; see Whitcombe 1984, p.36; Hansen 1995, p.5.
3. Much of the information given here is based on the excellent long essay in the catalogue of a sale at Sotheby's, London, 29 April 1993, pp.98–113.
4. The 18th- and 19th-century Slovenian practice of painting the fronts of beehives with elaborate designs may represent the diffusion of beekeeping practices from eastern Islamic lands through the Muslim Balkans; see Makarovič 1967.

204 (top), 205 (bottom)

204, 205

Two beehive covers
Iran, 18th or 19th century

Two stone-paste discs 21 cm in diameter, with a hole near the base for the bees to pass in and out of the hive; cat.204 is 1.2 cm thick and has underglaze painted decoration in white, black and green; cat.205 is 1 cm thick and has similar decoration in white, black and blue
accession nos POT1696.24, 25
provenance Collection of Dr. A. Middlehoek
published Sotheby's, London, 29 April 1993, lot no.188, nos 24, 25

Both covers are painted with talismanic designs centred on a representation of the human hand. Commonly referred to as the Hand of Fatimah, this served in all parts of the Islamic world as a protective talisman against the evil eye and evil forces in general.[1] On cat.204 there is an everted bird to one side of the hand, and a leaf to the other side.

1. See Doutté 1908, pp.317–27; Canaan 1937–8, p.147; Donaldson 1938, p.208; Shinar 1991, pp.133–4. See also Part One, pp.140–42 for amulets of this design in the Khalili Collection.

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Beehive and cover
Iran, second half of the 19th century

Wattle-and-daub cylinder 85 cm long and 30 cm in diameter, one end open, the other closed off by a disc of wattle and daub set 8 cm back from the opening and held in place by crossed sticks, which rest in turn on a horizontal wooden bar; the disc is faced by a round stone-paste cover 23 cm in diameter, with underglaze painted decoration in yellow, blue, green, red and purple-brown, which is held in place by the lip of the cylinder; both the wattle disc and the ceramic cover have a small hole at the base for the bees to pass in and out of the hive
accession no. POT1696.1
provenance Collection of Dr. A. Middlehoek
published Sotheby's, London, 29 April 1993, lot no.186

The ceramic cover of this otherwise utilitarian object is decorated with a vertical row of three cartouches, which are each inscribed in *thulth* script with an invocation. That in the top cartouche is *Yā qāḍī al-ḥājāt* ('O Judge of necessities!'), spelt *Yā qāfī al-ḥājāt*; that in the middle is *Yā kāfī al-muhimmāt* ('O Sufficient in difficulties!'); and that in the bottom cartouche reads, *Yā dāfiʿ al-baliyyah* ('O Protector against adversity!'). The inscriptions are in purple-brown on a white ground, and the blue field around the cartouches is enclosed by a yellow circle, which is in turn surrounded by a band of floral motifs.

The wooden or wicker cover that usually closed the rear of the hive is missing from this example.

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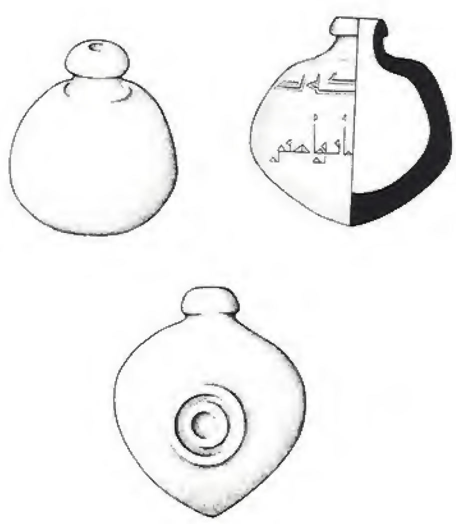
Sphero-conical vessels: a typology of forms and functions

by Emilie Savage-Smith

The problems

The class of objects usually referred to collectively as 'sphero-conical vessels' has elicited even greater controversy than the 'cupping-glasses' discussed in Part One, pp.42–7. Nearly all the pieces share certain common features: a general form that, though unstable if unsupported, would allow the vessel to be set at any angle if placed in sand or on a ring-base; a single small aperture in a knob-like top which often surmounts a recessed collar; and thick walls. The recessed collar beneath the knob-like head would also permit suspension by means of a cord or leather thong, and all of the objects, including those without a recessed collar, could have been suspended in a sling or net.[1] Included under the general rubric there are, however, objects that are not only made of different materials but that were also evidently meant for very different purposes.



Type 1

Type 2

The marginal illustrations to this essay are of the following objects (reading top to bottom and left to right):
Type 1—New York, Metropolitan Museum of Art, acc.no.40.170.235 (after Wilkinson 1973, no.109); after Ghouchani & Adle 1992, p.81 and p.75.
Type 2—Tehran, Iran Bastan Museum, inv.no.A.S.878 (after Wilkinson 1973, no.117).

The variety of materials from which such sphero-conical objects might be made is indicated by the examples in the Khalili Collection, which include vessels of a dense unglazed ceramic (cat.207 and 208), of unglazed earthenware of apparently greater porosity (cat.209) and of glass (cat.210–13).

The shape of the vessels also varies from the completely spherical, to those which are slightly elongated towards the bottom, to very elongated ovoids, to the conical. Except for some of the glass examples, most are decorated, some with quite elaborate designs and occasional inscriptions.

Large numbers of these so-called sphero-conical vessels are preserved today, though relatively few have been published. Examples of earthenware types have been found at medieval Islamic sites from Egypt, Syria and Iraq eastwards through Iran, Afghanistan and Russian Turkistan.[2] In Iran, Syria and Egypt (at Fustat), they have been excavated at a number of sites datable to between the 10th and 13th centuries, and at one site in Iran, Sultaniyyah, assigned to the 14th century.[3] Often a single site has yielded several different types of earthenware sphero-conical vessel. At Nishapur, Types 1, 2, 4, 5 and 6 in the following typology of forms were found, with Type 4 particularly prevalent in the area of a kiln, together with large quantities of wasters.[4] Types 3, 4 and 7 were found near Samarqand, along with agglomerated sphero-conical wasters.[5] At Rayy, Types 1, 4 and 6 were found.[6] In the case of glass sphero-conical containers, no provenance is available on any of the recorded examples except for an enamelled Mamluk specimen.

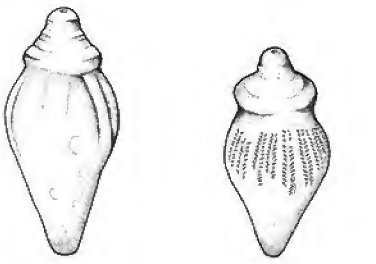
Just as with the 'cupping vessels', there are no written records that unequivocally describe any of these objects, and only their design and material construction provide an indication of their possible use. No attempt has been made here to cite all the published illustrations, much less provide a comprehensive list of the artefacts, but based on the known specimens a simple list of physical types is proposed against which the many suggestions for their intended function may be tried.

Typology

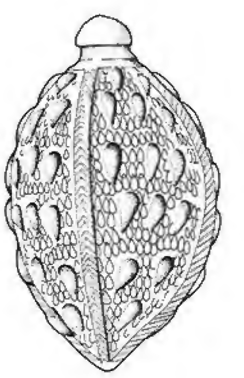
This preliminary survey suggests that there are at least ten categories of object that have in the past been grouped under the single umbrella term of 'sphero-conical vessel', and gives their basic physical characteristics and likely function. The arguments for and against some of these uses are set out in more detail below.

Type 1. Spherical earthenware vessels

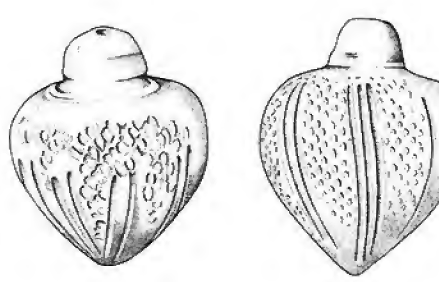
These have scarcely any point at the bottom and the underside is sometimes slightly flattened. They have relatively large apertures and sparse decoration, although five recorded examples bear inscriptions confirming their use as receptacles for the sparkling



Type 3



Type 4



Type 5

Type 3—after Paris 1992, nos 298 and 301.
Type 4—cat.208.
Type 5—Kuwait, Dar al-Athar al-Islamiyyah, inv. no.LNS 345C (after Qaddumi 1987, p.50); London, Victoria & Albert Museum (after Lane 1947, pl.36–F).

drink *fuqāʿ*.[7] Judging from the published photographs, they may also have been made of a slightly less dense earthenware than vessels of Type 4, for instance: if the clay of such drinking vessels were slighty porous, the resultant seepage might be beneficial, cooling the contents slightly through evaporation. The flattened base of some examples would also be appropriate for beverage containers, since they could be placed on a flat surface without risk of spillage. However, exactly how many known sphero-conical vessels of different proportions and materials might also have served such a function is highly problematic.

Type 2. Pear-shaped earthenware vessels

These objects have rounded bottoms and little decoration. They were probably also beverage containers, as *fuqāʿ-i gulābī* (pear-shaped containers for *fuqāʿ*, a sparkling beverage or beer) are mentioned in the literature.[8]

Type 3. Parsnip-shaped earthenware vessels

These have an exaggerated tapered bottom and bulging shoulders surmounted by four or five rings that decrease in size up to the pierced knob on top. They have no recessed collar.

It is possible that they too were beverage containers, although from the published illustrations they appear to have been made of denser clay than Types 1 and 2.[9]

Type 4. Dense, unglazed earthenware vessels, often with almond-shaped bosses

These objects appear to have been formed around a spherical or ovoid wax mould. The clay of which they and related items are made is very dense and well-levigated.[10] They were fired at and can withstand very high temperatures; they are apparently impervious to liquids and resistant to great internal pressure.[11] Their capacity is generally less than that of Type 2 vessels; they have thicker walls and are considerably heavier in proportion to their size.

Often a distinctive dark grey, grey-green or brown in colour, they frequently have almond- or teardrop-shaped bosses as part of their design. Cat.207 and 208 in the Khalili Collection are of this type.

Such vessels must surely have had a quite specific function.[12] If zoomorphic clay objects with single openings and stamped designs are considered to be aeolipiles, it is difficult to see why the argument cannot be extended to these sphero-conical objects. They may also have been used as plumb bobs.

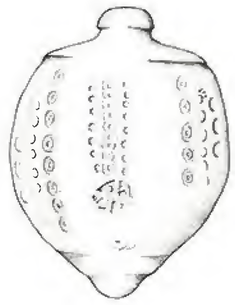
Type 5. Conical vessels of dense earthenware

These items have no recessed collar; their relatively broad and thick necks gently taper to the top. The body is divided by incised vertical lines into eight panels filled with a stamped design resembling fish scales or feathers.

The clay from which they appear to be made is of the denser variety so that they may also have been suitable for use as aeolipiles.[13]

Type 6. Conical porous earthenware vessels with elaborate designs

These appear to be made of a clay less dense than in the previous two categories and are formed from two pieces, pressed in a hollow mould and joined at the shoulder.[14] They often have applied designs of entwined serpents and sometimes, as in cat.209, benedictory inscriptions. Nearly all the objects in this group have some concentric rings lightly incised near the bottom of the vessel, and all have clearly recessed collars; it is unknown if they were glazed on the inside.



Type 6

Such vessels may have performed a function that made use of a more porous surface, such as holding rose-water that would permeate its walls, or serving as a pomander or possibly a beverage container. Their extensive decoration suggests that they were not to be destroyed after use.

Type 7. Glazed earthenware vessels

Some of these bear benedictory inscriptions which suggest their use as containers for valuable perfume and essential oils whose loss would be inhibited by the glazed walls. Only a few examples of this type are recorded.[15]

Type 8. Thick-walled glass objects

These have recessed collars under their knob-like necks.

Unlike other glass sphero-conical vessels, those of this type would probably not have served as perfume bottles, given their instability and the awkwardness of holding such a heavy piece in one hand to dispense the scent. Their thick walls might have avoided breakage when transporting mercury, but their great weight would have been a disadvantage. They are easily suspended and may have been used as plumb bobs. Cat.210 in the Khalili Collection is an example.[16]

Type 9. Thin-walled glass vessels with decoration

Vessels in this category have relatively wide openings and walls thinner than the thick-walled glass and earthenware objects. They are usually without recessed collars – although some exceptions, such as cat.211, do have this feature – and would therefore require a ring-support for stability. There is considerable variation in size, shape and decoration within the group. Some vessels of the usual body shape have a flat wide collar only slightly raised above the shoulder of the vessel rather than a protruding neck, as on cat.212 and 213. Both examples have small handles attached to the shoulder of the vessel, though these are only fragmentary on cat.212.[17] Decoration may be cut,[18] or applied (in which case the vessels often have a very long tapered body)[19] or moulded as on cat.211 and 212.

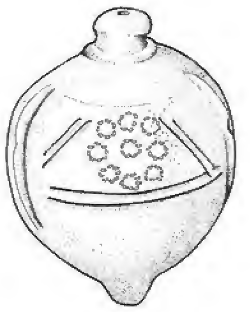
Three recorded examples with enamelled designs were made for 13th-century rulers, one for the Mamluk amir al-Shamsi al-Din Altunbugha and the other two for the Rasulid ruler of Yemen, al-Malik al-Ashraf ʿUmar II.[20] These must surely have served as containers for valuable liquids such as perfume, essential oils or mercury.

Type 10. Thin-walled glass vessels without decoration

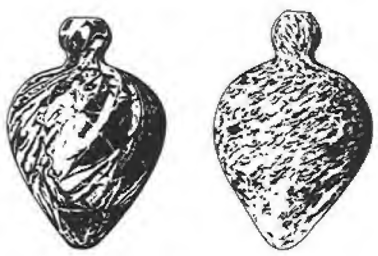
Vessels of this type have wide, nearly straight, necks suggestive of a cucurbit.[21] The opening is in the same position as the knob on the earthenware forms and is generally wider than on those vessels. Of all the objects classed as sphero-conical vessels, they are the most easily filled and emptied and also the most easily broken.

Such objects could easily have served as a boiling vessel or cucurbit under an alembic in alchemical apparatus. They could also have been used as inkwells and resemble some illustrated in miniatures, for instance, those in a 1581 copy of the *Shānshahnāmah*, the verse chronicle of the reign of Sultan Murad III. In a miniature showing part of the observatory built in Istanbul in 1577, two items of this shape are depicted amongst an array of tools and instruments spread out on a long table, as well as one on a small table in the lower corner of the miniature.[22] All three are placed near men who are writing and drawing, so that it is likely that they represent inkwells.

Type 6—above, New York, Metropolitan Museum of Art, inv.no.38.40.277 (after Wilkinson 1973, no.116); below, London, private collection.



Type 7



Type 8

Type 7—after Paris 1992, no.300
Type 8—Oppenländer Collection (after von Saldern *et al.* 1974, p.255).

Function

Of the many proposed uses for this large class of objects, those backed by the most convincing arguments are discussed below. Other theories with less support include loom weights, architectural decorations, lamps, and devices for striking fires.[23]

The function once most often attributed to these items, but now increasingly rejected, is that of grenades or incendiary devices.[24] The thick walls and small orifice would have been suitable for such a device lit by a wick, and it has also been suggested that such vessels could have been heated in a tray of sand until warm enough to expel a jet of inflammable vapour.[25]

Medieval military treatises, such as that written by Ibn Aranbugha al-Zaradkash in AH 867 (AD 1462–3), the longest and most profusely illustrated work on incendiary projectiles, describe several types of incendiary device, including trebuchet bolts (*sahm manjanīq*), stone projectiles (*ḥajar manjanīq*), clay pots, boxes and glass bottles containing naphtha (*qudūr* or *karrāz al-naft*, *sundūq* and *birtām al-naft*) and fir-lances (*rumḥ*).[26] None of these illustrations or descriptions, however, corresponds in detail to any of the sphero-conical vessels preserved. Glass grenades to be carried by flying arrows or rockets had to be light, in contrast to the great weight, even when empty, of many of the vessels of Type 8, above, although some of those of Type 10 may have served such a function.

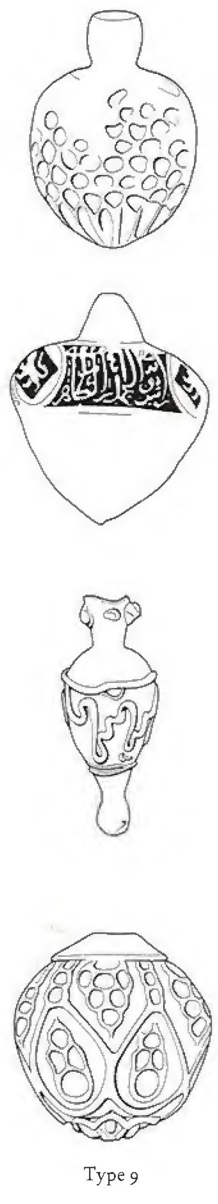
The careful and often elaborate decoration of the earthenware Types 2–7 and the glass Type 9, however, immediately argues against a function which necessitated their destruction, and those bearing inscriptions – Types 6 and 7 and the enamelled glass of Type 9 – present clear evidence that they were not intended for such a fate. Moreover, the thick walls of all but Types 9 and 10 would have had the disadvantage of not breaking easily upon impact.

Finally, the ingredients given in the medieval treatises for compounds used in incendiary devices could not have been introduced into the vessels through their small apertures. Experiments with nearly all the items in the Khalili Collection demonstrate that they can be filled only with a very thin liquid, such as water, not a viscous one.[27] The mixture of flammable oils described in the treatises for use in incendiary devices was, by contrast, so thick that the degree of viscosity was even graded.[28]

Although only a very few of the recorded sphero-conical earthernware vessels have been glazed externally, and then sometimes rather casually, a fragment of one glazed example found in southern Azerbaijan bears an inscription addressed to a woman, suggesting that it, and possibly other externally glazed or decorative glass vessels, might have been intended as a scent bottle or vapourizer.[29] Two ceramic examples in the Khalili Collection that were filled with water, cat.207 and 208, were difficult to empty except by shaking the liquid out drop by drop, and such a method of dispensing might have been appropriate for an expensive perfume. It has also been suggested that the vessels were heated to produce a perfumed steam, a purpose for which their shape would be appropriate,[30] but in general the advantage over an ordinary perfume bottle of such a heavy object, which is difficult to hold in one hand and cannot rest easily in a stable position, is not readily apparent.

Other sphero-conical vessels, however, of a relatively light, porous clay (Type 6, above) may have been containers for rose-water or essential oils. On the assumption that the interiors of such objects were unglazed, it was perhaps intended for the liquid to permeate the walls so that they would serve as pomanders to scent a room. The inscription on the example in the Khalili Collection, cat.209, although general, implies that the giver of the vessel considered it a valuable item offering continued use and benefit to its owner.

One of the most intriguing proposed functions that could employ a vessel of Types 4 and 5, of unglazed earthenware with thick walls of dense fireproof clay and a very small



Type 9

opening, is that of an aeolipile or fireblower.[31] This contrivance, which uses the energy of steam to quicken a fire, has a history that goes back to Vitruvius. It was a ball-shaped object with a single small orifice and internal cavity filled with water. When placed on or near a fire of wood or charcoal (coal does not produce heat of sufficient intensity) the steam released at the orifice mixed with air before reaching the flames, and so acted as a type of bellows, which did not need an operator to work it continuously. When all the steam had been discharged, the aeolipile could be easily recharged using a funnel or by placing it under water while still warm. The heat expanded the air within so that when the device was submerged the water was drawn inside. No classical examples are preserved, but 15th- and 16th-century European earthenware aeolipiles of human shape are extant, and medieval Islamic earthenware vessels of various animal forms, particularly in the shapes of birds and fish, are accepted as probable aeolipiles.[32]

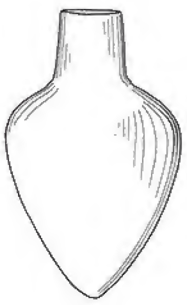
In this context, the thick earthenware walls of some of the sphero-conical vessels might permit greater retention of moisture, provide a weight helping to stabilize the vessel's position, and withstand considerable internal pressure. It is possible – although undemonstrated – that the particularly dense form of earthenware employed in Type 4 vessels such as cat. 207 and 208 is especially suitable for this purpose and that the distinctive dark grey, grey-green or brown colour associated with many such examples resulted from their repeated use in this fashion. That they are highly decorated would be in keeping with a household object that was used repeatedly, and the large bosses which are another feature of Type-4 vessels could perhaps have helped in stabilizing the object further. Indeed, the overall shape of the sphero-conical objects, like those of alchemical vessels, would be advantageous when needing to set the object in the ashes around a fire and hold it at an angle so that the steam was discharged near the base of the fire. An illustration in an undated manuscript shows what appears to be a sphero-conical aeolipile being used under a cucurbit in an alchemical apparatus.[33]

On the other hand, no examples have been recorded as having traces of soot and ashes on them nor any sign of having been used in fireplaces or ovens. Nor have any been excavated in fireplaces, though a considerable number have been found in kilns. Several vessels were found at the bottom of a kiln at Balis on the Euphrates, joined together in a way that suggested to one scholar that they were used in the regular functioning of the kiln, possibly to maintain the required temperature of the fire.[34]

Another ingenious suggestion for the use of sphero-conical vessels is as containers for mercury.[35] The main evidence presented in favour of this hypothesis is that three vessels purportedly of this type, one from Sidon and two from Russian Turkistan, contained traces of mercury, while a fourth (kept in the Rumianov Museum in Moscow until the First World War) was said to be half-filled with mercury.[36] Additional support for the theory came from an oral tradition in 19th- and early 20th-century Armenia and Russian Turkistan that such containers had been used for both mercury and bleaching powders, though the practice had been discontinued by the time the tradition was recorded.[37] Finally, there is evidence that in 11th-century Egypt the term used for a container for mercury or honey was *fuqqāʿah*, meaning gourd-like or spherical.[38]

The possible use of the glass sphero-conical vessels as mercury containers is also suggested by the 12th- to 13th-century physician Abu al-Fadl Hubaysh ibn Ibrahim al-Tiflisi, author of the treatise *Bayān al-ṣināʿāt* ('Explanation of the Arts'), who, in discussing the preparation of the artificial painting pigment cinnabar (vermilion), specified that mercury and one-fourth as much yellow sulphur should be placed in 'a thick sphero-conical

Type 9—Tehran, private collection (after Ettinghausen 1965b, pl.LXVII–A); after Ettinghausen 1965b, pl.LXVIII–A; Ettinghausen 1965b, pl.LXVII–B; cat. 212.



Type 10

[*turanjī*] glass vessel, that is to say, [a vessel] with a narrow base and a narrow neck like the beer gourd [*kūza-yi fuqāʿ*]'.[39]

In the medieval Islamic world the primary use for mercury (*zībaq*) was in the extraction of gold by amalgamation.[40] It was also used in gilding, in the production of the artificial pigment cinnabar, in alchemy, and in counterfeiting coins. Although it was widely recognized that mercury was toxic if ingested, many writers of medical formularies also recommended the use of mercury in various compound remedies. Al-Kindi, for example, writing in the 9th century, recommended mercury, frankincense, musk and two other ingredients for a clyster to be introduced into the urethra as a remedy for dripping urine.[41] Some medical writers, however, apparently had little first-hand experience with it, for they sometimes repeat unquestioningly errors and misinformation from earlier writers. Even Dioscorides, whose 1st-century treatise on materia medica formed the basis of later Islamic pharmaceutics, clearly had not the experience with mercury he pretends, for he stated that it could be kept in glass, lead, tin and silver containers when in fact it will quickly dissolve all but the glass.[42] By the 14th century, mercury had become popular in eastern Islamic lands for the treatment of various skin lesions including leprosy and smallpox, and when syphilis became a major problem in the 16th century, mercury was for a time the drug of choice in both Europe and the Middle East. The demand for mercury increased after the 14th century, but by then the sphero-conical vessels under discussion had largely ceased to be produced, except for the Mamluk enamelled-glass versions.

Transoxiana was an important mercury-producing area for the eastern provinces, and there were small mining sites in Iran, while Spain was the major supplier for the western Islamic lands.[43] There was a vigorous trade in mercury from Spain to Alexandria and Fustat via Tunisia, and there is some evidence that this was extended to India, passing through Aden.[44]

The fact that mercury is a highly volatile and corrosive substance means that it is usually stored in glass containers.[45] Modern transportation of mercury does employ a type of flat-bottomed container made of very dense earthenware, which opens up the possibility that medieval vessels of dense clay were also employed for its transport. The vessels would need to have been stored upright, however, for the pressure of the volatile mercury inside a flask laid horizontally, as proposed by Richard Ettinghausen,[46] would have forced the seal open. The instability of the sphero-conical vessels thus argues against their common use as mercury containers. Moreover, the extraordinary weight of a heavy earthenware vessel filled with mercury argues against the transport of large numbers of such containers at one time. The assertions that mercury was present in some vessels seem to have been based on visual identifications made in the 19th and early 20th centuries, and no tests by modern laboratories have revealed the presence of mercury in other artefacts. On the other hand, few have actually been analysed in a laboratory.[47] Given the importance of mercury production in Spain, it is very significant that none of the sphero-conical vessels of the sort being discussed here is associated with Spanish sites.

Support for the mercury theory has also been given by citing an illustration in a manuscript copy of the *Ikhtiyārāt-i Badīʿī* ('Selections for Badiʿ'). This was a popular and comprehensive Persian-language pharmacopoeia of simple and compound remedies composed in AH 770 (AD 1368–9) by ʿAli ibn Husayn Ansari Shirazi, known as Hajji Zayn al-ʿAttar, for the princess Badiʿ al-Jamal, of whom very little is known. Numerous copies of this treatise are preserved today, and in one of them, made in AH 948 (AD 1541) and now in Tashkent, there is an illustration of three sphero-conical containers in the section dealing with mercury.[48] These containers are, however, radically different from any of the sphero-

Type 10—New York State, Corning Museum of Glass (after Ettinghausen 1965b, pl.XLVI–B).

conical vessels under discussion here. The small, knob-like top has no aperture, but rather acts as a handle for a broad, hemispherical cover that rests on a cone-shaped body. Only in silhouette are these two-piece, apparently glass, containers comparable to the sphero-conical items. What their precise function was in terms of mercury production and storage is not evident from the text. Moreover, in the only other recorded illustrated copy of the treatise, which was completed in AH 1058 (AD 1648) and is now in the Khalili Collection,[49] the section on mercury is not illustrated. The original treatise itself was not illustrated and the text does not supply a description of the vessels.

In a recent study it has been convincingly argued that a number of sphero-conical vessels were used in the manner of a *fuqqāʿah* or gourd, as containers for beverages or 'beer'.[50] A fragment of an earthenware vessel found at Oren Qalʿa (Baylaqan) in southern Azerbaijan bears an inscription in Kufic that not only gives the name of the potter, Ahmad ibn Fadlun, but also includes wishes for divine grace (*barakah*) to its owner and the salutation 'drink to your good health' (*ishrab haniyyan*).[51] Three examples of undamaged earthenware sphero-conical vessels from Iran, attributed to Rayy, have the name of another maker, Hamshad, and the admonition to the owner to drink to his or her good health,[52] which is also found on a fourth vessel, made by one Ahmad ibn Musa.[53] All four of these vessels are assigned to the Buyid period of the 10th to the early 11th century.[54]

It seems incontestable that at least these four vessels were used to hold a beverage. *Fuqāʿ* or *fuqqāʿ* is a term associated by some with a fermented drink made of raisins and by others with a non-alcoholic sparkling drink often made from barley, whose popularity had faded by the end of the 14th century.[55] The drink was poured into the vessel which was then sealed with a piece of leather tied round the knob and left to cool, preferably on ice or snow. When desired, the seal was pierced and the liquid consumed directly from the container. In Arabic the gourd-shaped storage vessel for such a drink was called a *kāz* ('jug') *al-fuqqāʿ* or a *fuqqāʿah*, the same term apparently used in Egypt for containers of mercury or of honey, and a number of Iranian writers and poets mention the *kāza-yi fuqāʿ*.[56]

The four examples whose inscriptions bear witness to their use as beverage containers are relatively small in height and are exactly spherical in form, except for one which has a slightly flattened underside. They also have relatively little decoration, except for the incised inscriptions, and are of a porous clay which places them in Type 1 of the forms presented here. Pear-shaped *fuqāʿ*-containers (*fuqāʿ-i gulābī*) are also mentioned in the medieval literature, which suggests a function for artefacts of Type 2.

Clearly, however, one must be wary of extending this explanation to all or even most of the known examples. Beverage containers would have required a larger opening than is found on some of the extant sphero-conical vessels, for example.[57] The earthenware from which the beverage containers appear to have been made is relatively porous – a useful feature when wishing to cool a liquid, for the temperature of the contents is lowered by evaporation of seepage through the walls. Consequently, those sphero-conical vessels of dense clay fired at a very high temperature, such as Types 4 and 5, appear to be unlikely candidates for this function, in addition to which they have quite small apertures. A sufficiently porous clay is evident in Types 1, 2 and 6 described above, though the latter type is distinguished by a different method of manufacture and a high degree of ornamentation.

Plumb bobs were an essential part of the building trade, and were used in astronomical observation. Attached to a string and allowed to hang free of obstruction, they allowed one to establish the vertical when aligning walls and other architectural features or surveying with triangular levels, and served as a reference when reading angular measurements from

astronomical observational instruments. Despite their somewhat mundane function, it is not unreasonable that many of them were made of attractive, yet heavy, materials. All the so-called sphero-conical vessels of sufficient weight might have been used in this way.

Finally, it has been recently proposed that a sphero-conical vessel could be used as the base of a water-pipe.[58] Such a theory presupposes the otherwise undocumented practice of smoking a substance, presumably hashish, some 300 years before the introduction of tobacco. The vessels themselves do not have apertures large enough to accommodate the pipe stem, nor a platform on which the substance might be burnt. A Mughal water-pipe of dark-blue glass in the Khalili Collection (GLS 485, ex-catalogue) reveals in its coconut-like form a similarity to certain sphero-conical vessels but also has a hole in the side of the body necessary for the pipe stem and the requisite open top for burning the substance.

For well over 100 years scholars have puzzled over these curious, unstable objects. As more examples are studied and compared, more subgroups will no doubt emerge and even more functions will be proposed.

1. Those examples which lack or have only a slightly recessed collar inevitably have a noticeably wider knob and a larger aperture at the top, as well as a spherical or squat conical body.
2. For a list of nearly 50 sites, see Ettinghausen 1965b, p.218. See also Ghouchani & Adle 1992, p.72.
3. See Lane 1937; Ettinghausen 1965b, p.218; and Rogers 1969, p.148, n.3; Yusuf 1978; Ghouchani & Adle 1992, p.72 and p.87, n.8.
4. Wilkinson 1973, pp.323, 324 and 353.
5. Paris 1992, nos 298–301.
6. Ettinghausen 1965b, p.218; Ghouchani & Adle 1992, pp.77–84.
7. See the discussion on p.330.
8. One example, in the Iran Bastan Museum, Tehran, found at Nishapur is illustrated in Wilkinson 1973, p.353, no.117; Ghouchani & Adle 1992, p.77, fig.13 (and see above, p.324). It is sparingly decorated and has a rounded rather than pointed underside.
9. For examples, see Paris 1992, p.68, nos 298 and 301 (and see p.345); and Hildburgh 1951, pl.XVI, row b, second from left (now in the Victoria & Albert Museum, London).
10. Rogers 1969, p.150, n.9, suggests that the clay from which this group of sphero-conical items was made is a contender for the 'philosopher's earth'.
11. The porosity of the examples in the Khalili Collection has not yet been tested, but apparently similar examples found at Nishapur made of a 'thick heavy greenish pottery' were found to hold liquids, water and oil for weeks without seepage: see Hauser & Wilkinson 1942, p.89.
12. Similar examples made of green-grey clay and also having almond-shaped bosses are in Düsseldorf, Hetjens Museum, inv no.16112 (Zusammenarbeit/Berlin 1973, p.118, item 152); Paris, Musée du Louvre (illustrated in Hassan & Hill 1986, p.109, fig.4.13[b] in middle); University of Chicago (illustrated in Ettinghausen 1965b, plate XLV–B) found at Rayy . There is an unpublished example in Oxford, Ashmolean Museum (Dept. of Eastern Art, inv. no.X444) of dark-grey clay, 16.3 centimetres in length, with a maximum diameter of 10.2 centimetres and an opening 0.4 centimetres across. The Ashmolean also has two examples of a very dark brown colour decorated with very small tear-shaped bosses with the ground cut out around them (inv. nos 1974.27 and 1994.70); both are rather squat conical items; the latter 12.1 centimetres long, with a maximum diameter of 9.4 centimetres and an opening 0.8 centimetres across.
13. Examples include one in Toronto, Royal Ontario Museum (illustrated in Keall 1993, p.277, fig.1); two in the British Museum and one in the Victoria & Albert Museum, London (illustrated in Hildburgh 1951, pl.XVI, group C [in the middle] and group B [on the left] – the latter also illustrated in Lane 1947, pl.36, item F, where it is said to have come from Raqqa and to have a green glaze, and above, p.325); Paris, Musée du Louvre (illustrated in Hassan & Hill 1986, p.109, fig.4.13[b]); Kuwait, Dar al-Athar al-Islamiyyah, inv. no. LNS 34C (illustrated in Qaddumi 1987, p.50, and above, p.325). See also one devoid of decoration in New York, Metropolitan Museum of Art, inv. no.38.40.278, (illustrated in Willkinson 1973, pp.323 and 353, item 113). An unpublished example in Oxford, Ashmolean Museum (Dept. of Eastern Art, inv. no.X445) is a dark, rich brown colour, 12.5 centimetres in length, with a maximum diameter of 9.8 centimetres and an opening of 0.4 centimetres; it is decorated with three vertical v-shaped panels stamped with eight-petalled flowers, alternating with three panels stamped with teardrops arranged as feathers or fish-scales. A second example in the Ashmolean (inv. no.X443) is similar in design except that it is more elongated and has straight vertical panels of stamped designs (length 13 centimetres, maximum diameter 8.5 centimetres, opening 0.4 centimetres).
14. Other examples are illustrated in Ettinghausen 1965b, pl.XLV–C and L–B; Rogers 1969, p.152, pls 1 and 2, p.154, fig.3 and p.155, pl.3;

and Wilkinson 1973, p.353, no.116. Five others are listed in Rogers 1969, p.153, n.12. In Oxford, the Ashmolean Museum (Dept. of Eastern Art, inv. no.1990.1274) has an example of one moulded in a light red clay whose surface is darkened and dirty; the exterior is decorated with four rows of a large stamped design containing a six-pointed star. The vessel is 14.5 centimetres long, the diameter of the shoulder 8 centimetres, the maximum diameter 9.3 centimetres, and the opening 1.1 centimetres.

15. Several examples are recorded as having a turquoise glaze: London, British Museum, inv. no.72 7-29 8; Paris, Musée des Arts Décoratifs, inv. no.10951B; and Paris, Musée de Sèvres, inv. no.MNS.18632. See Ghouchani & Adle 1992, p.87, n.5; and Paris 1992, p.115, no.300, illustrated on p.68 (and see above, p.327). A green glaze is evident on an unpublished example in the Ashmolean Museum, Oxford (Department of Eastern Art, inv. no.X446), with an aperture measuring 0.6 centimetres across, a maximum diameter of 6.4 centimetres, and a length 11.4 centimetres, and only a small recessed collar.

16. For other examples, see von Saldern *et al.* 1974, nos 745 and 746. The Khalili Collection also has a remarkable thick-walled bottle of blown green glass, GLS 384. It is melon-shaped, stands 35 centimetres high, and is ground and polished with sparing wheel-cut decoration. The rim at the neck was indented at the time of manufacture, indicating that liquids were to be poured from it. It appears to be a piece of the 5th to early 7th century AD, from Iran or Iraq, and while its size places it outside the scope of objects usually designated 'sphero-conical vessels' its overall design and date suggest that sphero-conical storage containers for liquids can be traced back to early Islamic or Sasanian wares. For further discussion of this item, see Goldstein, forthcoming.

17. See Ettinghausen 1965b, pl.XLIX–A for an example in a private collection in Tehran that is similar in design to cat.212 and also has a small handle on its side.

18. For an illustration of one made of dark-blue glass in a private collection in Tehran, see Ettinghausen 1965b, pl.XLVII–A, and above, p.328.

19. One example is illustrated in Ettinghausen 1965b, pl.XLVII–B. For other examples in the Khalili Collection, GLS 571 and GLS 247, see Goldstein, forthcoming.

20. Ettinghausen 1965b, pl.XLVIII–A illustrates one that was made for Altunbugha (and see above, p.328). For the two made for the Rasulid rulers, now in the Musée du Louvre, Paris, and the Victoria & Albert Museum, London, see Ettinghausen 1965b, p.224, n.19; and Hauser & Wilkinson 1942, p.90.

21. For example, an amber-coloured vessel in New York, Corning Museum of Glass (illustated in Ettinghausen 1965b, pl.XLVI–B and above, p.329).

22. Istanbul Üniversitesi Kütüphanesi, MS.FY.1404, fol.57a, reproduced in Nasr 1976, pl.65 (opposite p.112), and in Savage-Smith 1992a, p.27, fig.2.10, where the author incorrectly grouped these three items with the plumb bobs in the description of the painting.

23. See Brosch 1980 for the theory that they were used for striking fires, proposed on the basis of the chemical analysis of a broken spherical example in the collection of the Department of Antiquities and Museums of Israel. The sample was found to contain 22% ferric sulphate, which, it is argued, was produced after oxidization of the original material consisting of iron pyrite.

24. W. Gohlke (1912–14) tested his theories with modern replicas. For arguments against his identification, see Ettinghausen 1965b, pp.225–6; Seyrig 1959, pp.84–7; and Ghouchani & Adle 1992, pp.72–3. For recent advocacy of the grenade theory, see Hassan & Hill 1986, p.109.

25. Hildburgh 1951, p.55. For an illustration of a Chinese sculpture of about AD 1128, showing a demon carrying in his right hand a sphero-conical smoking 'bomb', see Gwei-Djen, Needham & Chi-Hsing 1988, p.600.

26. See Zaradkash, p.165 to the end. For *naft*, see Richardson, Christides & Ferrier 1993; and Colin *et al.* 1960.

27. Cat.209, the porous clay of which made it inadvisable to fill the vessel with a liquid, was not tested.

28. Hassan 1987, p.161. An incendiary oil of the lowest level of viscosity could be distilled from yellow pine wood, broken into splinters and soaked in tar – obtained from various conifers – mixed with sesame oil, while a typical incendiary oil of greater viscosity was obtained by distilling a mixture of olive oil, wine, storax, mastic gum, sandarac, quicklime and crushed bricks: see Hassan 1987, p.163.

29. Rogers 1969, p.150, n.10; see also Lane 1947, p.27; and Seyrig 1959.

30. Hildburgh 1951, p.53.

31. Also spelt aeolipyle and eolipile. This suggestion was first and most convincingly argued by W.L. Hildburgh (1951, see especially pp.52–4 and pl.XVI).

32. See Hildburgh 1951, pp.29 and 48; Ettinghausen 1965b, p.228, fig.14; Dumarçy 1965, p.75; Wilkinson 1973, pp.324 and 353 item 115; and Rogers 1969, p.148, n.4. Of these recorded examples of zoomorphic vessels, those of known provenance were found in Syria, Iran (Nishapur), Afghanistan and Uzbekistan. One, in the form of a bird, was previously described as a child's drinking vessel.

33. Matenadaran MS.3204, reproduced in Rogers 1969, p.151, fig.1.

34. Private communication by Michael Rogers, cited by Ghouchani & Adle 1992, p.73 and p.89, n.33; see also p.89, n.34, where a different interpretation is offered by Madame Marthe Bernus-Taylor. For an illustration of a conglomerate of earthenware sphero-conical vessel wasters found at Samarqand, see Paris 1992, p.69.

35. This theory was first seriously suggested by E. Lenz (1912) but most systematically argued by Richard Ettinghausen (1965b).

36. In 1871 minuscule drops of mercury were found on the wax-coated interior of a vessel from Sidon. In 1908 a vessel was found in the Russian village of Old Krym that had its neck closed with a wooden stopper sealed with wax; inside were 'remains of mercury'. In 1914 it was said that another vessel with traces of mercury was in the Museum of Kazan. See Ettinghausen 1965b, pp.219–20.
37. Ettinghausen 1965b, p.222.
38. Goitein's appendix to Ettinghausen 1965b, p.229.
39. Quotation taken from the translation in Ghouchani & Adle 1992, p.72; see also p.88, n.18. For other treatises by al-Tiflisi, see Ullmann 1970, pp.169–70 and 278; and Storey 1971, pp.213–14.
40. Allan 1979, pp.2 and 7.
41. Levey 1966, p.160 and pp.277–8, entry 132.
42. Riddle 1985, p.156.
43. Allan 1979, pp.1–3.
44. Goitein 1973, pp.99, 215 and 239; Goitein's appendix to Ettinghausen 1965b, p.229. See also Constable 1994, pp.215–17; and Allan 1976, pp.2–3.
45. Goldwater 1972, p.78.
46. Ettinghausen 1965b, p.223, fig.6.
47. From the large collection of sphero-conical vessels in the Department of Antiquities and Museums in Israel, only one broken specimen was analysed at the Hebrew University (see above, note 24). There were no traces of mercury.
48. The illustrations of the mercury containers are not to be found in any of the manuscripts or printed editions of this treatise except for that in Tashkent, reproduced in Ettinghausen 1965b, pl.XLVI–A.
49. Part One, cat.10.
50. Ghouchani & Adle 1992.
51. Rogers 1969, pp.149 and 155, fig.4, where a drawing reproduces the inscription.
52. Ghouchani & Adle 1992, pp.74–6: two are in Isfahan, Iranian Centre for the Study of Art and Architecture (figs 3–5 and 9–11), and one is in the Iran Bastan Museum, Tehran, (figs 14 and 17–22).
53. Iran Bastan Museum, Tehran; Ghouchani & Adle 1992, pp.74–6 and figs 14 and 23–7.
54. Ghouchani & Adle 1992, pp.81 and 83 and figs 17 and 23. The measurements of two of the vessels are published; both are 11 centimetres in height, while the diameter of one is 10.5 centimetres and of the other 11.9 centimetres.
55. Ghouchani & Adle 1992, p.78 and p.89, n.47–57.
56. For many examples, see Ghouchani & Adle 1992, pp.78–86.
57. This is exemplified by two of the vessels with inscriptions identifying them as beverage containers whose dimensions have been published; see above, note 55. Both of these have spouts with an orifice 1.4 centimetres in diameter. Ghouchani & Adle (1992, p.91, n.85) state that they measured openings on other vessels that were 'usually less than 5 mm in diameter' but that some were as wide as 1.5 centimetres. I would suggest that those of less than 5 millimetres in diameter were of a different shape and were intended for a different purpose.
58. Keall 1993.

207

Aeolipile or plumb bob

Provenance unknown

Fine, dense, unglazed earthenware; there is a slight indentation on the shoulder
height 13.5 cm
maximum diameter 10.7 cm
diameter of opening 0.5 cm
capacity 185 ml
weight 0.85 kg
accession no. POT1001

The fine, dense earthenware of which the vessel is made is very dark grey in colour. The shoulder is decorated with two rows of stamped, narrow teardrop designs with a double row of zigzag lines between. Around the body of the vessel a broad band comprising five rows of the teardrop motif forms the ground around four elongated almond-shaped bosses alternating with four round bosses. The ground was stamped with the design after the bosses were applied. Near the bottom of the vessel there are three deeply incised concentric circles and three more lightly incised circles that were pared away between the processes of burnishing and firing.

The x-rays taken of the vessel reveal that it was formed around a nearly spherical mould with a long slender neck, made of wax. The small hole in the knob-shaped top leads to the internal cavity.

Sphero-conical vessels of dense clay, fired at a very high temperature, are likely candidates for use as aeolipiles, though their roughly conical form would permit their use as plumb bobs. Classed as Type 4 in the typology of forms outlined in the essay above, their relatively narrow apertures, weight and limited capacity – due to the thickness of the walls – suggests that they would not have served as beverage or perfume containers.

208

Aeolipile or plumb bob

Provenance unknown

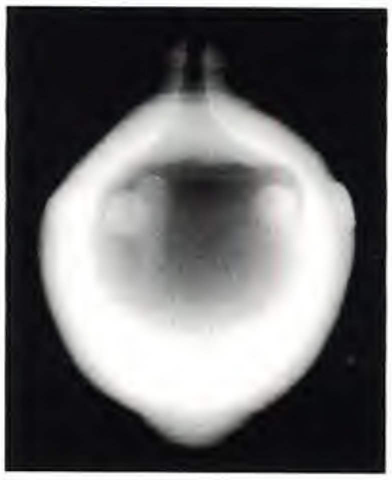
Dense, unglazed earthenware; there is an indentation on one side of the body
height 17.8 cm
maximum diameter 10.5 cm
diameter of opening 0.4 cm
capacity 170 ml *weight* 1.05 kg
accession no. POT1000

Like cat. 207, this unglazed vessel is made of dense, dark-grey earthenware, but it is of more elongated form with no clearly defined shoulder. Beneath the recessed collar the body is divided vertically into four segments by cables that meet at the bottom. Each of the four segments is filled with six or seven rows of almond-shaped bosses on a ground of small stamped teardrop motifs identical to those on cat. 207. The ground appears to have been stamped after the bosses and vertical cables were applied. The recessed area beneath the collar was cut away after burnishing but before firing.

X-rays reveal that the vessel was formed over an ovoid mould with a long slender neck. A similar piece, but lacking the cables, is in the Ashmolean Museum, Oxford.[1]

1. Department of Eastern Art, inv. no.x444. It is 16.5 centimetres high, with a maximum diameter of 10.2 centimetres and an aperture 0.4 centimetres across.

207



207, x-ray

208, x-ray

209

Container, perhaps for rose-water or essental oils

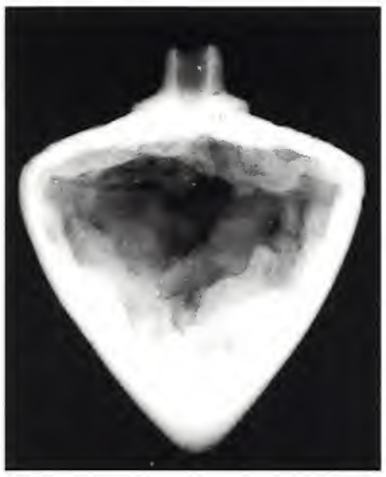
Provenance unknown

Unglazed porous earthenware
height 15.2 cm
maximum diameter 11.9 cm
diameter of opening 0.6 cm
weight 0.45 kg
accession no. POT376

The clay from which this vessel is made is much lighter and more porous than that of cat. 207 and 208 and is light tan in colour. It is unusual in terms of other published examples in that it is more decisively conical, with the plane of the shoulders sharply defined.

The body of the vessel is smooth but the shoulder carries a band of moulded benedictory inscriptions reading 'honour and prosperity and prestige'.[1] The inscriptions appear against a ground of intertwining vines and are interspersed with a small knotted design. At the upper edge of the conical body a band bears traces of an incised undulating design. Near the bottom point are four, very lightly incised, concentric circles.

X-rays reveal that the object was made in two pieces. The clay for the body was pressed into a hollow conical mould using the fingers, resulting in an irregular interior. A second mould was used for the top with the inscriptions. The two pieces were then joined along the shoulder of the vessel and the seam disguised by the band with the undulating design. A rod was pushed through the top to produce the opening.



209, x-ray

208

209

Classed as Type 6 in the typology of forms presented above, the vessel's porous walls suggest its use as a container for rose-water or essential oils, which would permeate the fabric so that it acted as a pomander. Alternatively it might have been used as a beverage container.

1. The last word, *al-thanā'* could also be read as *al-baqā'* ('long-life').

210

Plumb bob [?]

Provenance unknown

Yellow-green blown glass, with iridescent encrustation on the surface
height 12.1 cm
maximum diameter 8.75 cm
diameter of opening 0.6 cm
capacity 200 ml *weight* 0.40 kg
accession no. GLS 569

This sphero-conical vessel has a tapering base, a recessed collar, and a narrow aperture in the rounded knob which surmounts the collar. There is a pontil mark at the base. Its walls are very thick compared to those of the earthenware objects. There is no external decoration.[1]

A typical example of Type 8 in the typology of forms given in the essay above, the vessel has thick walls that might have avoided breakage when transporting mercury, but its considerable weight and its instability would have been disadvantageous. The vessel is awkward to hold in one hand, and consequently is unlikely to have served as a perfume bottle for dispensing scent drop by drop. It is easily suspended, however, and a likely function is as a plumb bob.

1. For two similar examples, one made of flecked, opaque green glass, 12 centimetres high and 8.2 centimetres in diameter, and one of dark-blue glass with marbling, 11.5 centimetres high and 8.5 centimetres in diameter, see Saldern *et al.* 1974, p.255, items 745 and 746.

210

210, x-ray

211–213

Three containers, perhaps for perfume, mercury or other valuable liquids

Provenance unknown

Pattern-moulded, aquamarine glass, most of the surface dull-finished
height 8.8 cm
maximum diameter 7.3 cm
diameter of opening 0.4 cm (widening to 1.3 cm) *capacity* 100 ml
weight 0.10 kg
accession no. GLS 553

The vessel has a pontil mark at the bottom, a greatly recessed collar, and decorative moulded indentations around the shoulder. The surface from the shoulder down to the underside is dull-finished.

Although within this group of thin-walled glass vessels – Type 9 in the typology of forms given in the essay above – it is unusual in having a recessed neck, it may, like cat. 212 and 213 below, have served as a container for valuable liquids such as perfume, or for mercury, or even as an inkwell.

Pattern-moulded, dark-blue glass
height 9.4cm *maximum diameter* 8.6cm
diameter of opening 0.5 cm
capacity 246 ml *weight* 0.10 kg
accession no. GLS 137

The vessel has a pontil mark at the bottom. Rather than a protruding neck, it has a flat, wide collar which is raised only slightly above the shoulder. Around the shoulder five ovoid panels alternate with five similar, but more elongated, ovoid panels around the lower body to form a net pattern. Grape-cluster designs fill each of the panels. On the bottom a pentagonal design encloses a five-petalled flower. There is a fragment of a handle on the shoulder.

Blown green glass, with areas of iridescence and extensive corrosion
height 8.5 cm *maximum diameter* 6.5 cm
diameter of opening 0.7 cm
capacity 90 ml
weight 150 g (approximate)
accession no. GLS 517

This object has a flat, wide rim which is slightly depressed where it surrounds the aperture. There is a pontil mark on the bottom. It is undecorated except for a simple trailed handle applied to the shoulder.

Although undoubtedly of the group of thin-walled, decorated sphero-conical glass vessels used to hold liquids, its plainness may indicate that it had a relatively utilitarian function, for instance, as an inkwell.

211

212

213

Stone press-moulds and leatherworking in Khurasan

by Ralph Pinder-Wilson

While the achievement of the Islamic world in the field of bookbinding has long been recognized and studied, little attention has been paid to other aspects of leatherworking. The history of decorative leatherwork in the West is well known since so much has survived but this is not the case for the Islamic lands, where examples of decorated leather from the medieval period – bookbindings excluded – are exceedingly rare. Hitherto, our evidence for the existence of decorated leather artefacts has been derived from items in other materials, such as the silver-inlaid brass wallet in the Courtauld Institute of Art, London, that is clearly the replica of a leather original.[1] It was probably made in North Mesopotamia about the middle of the 13th century and bears a striking resemblance to a leather handbag of today. On its lid there is even the depiction of a figure wearing a rectangular leather wallet slung over his shoulder.

In fact, pastoralism played an important role in the economy of the Middle East from ancient times, and Islamic society certainly inherited all the various processes required for preparing and tanning hides and skins for the numerous uses of leather in daily life. These ranged from footwear, belts and containers to equestrian and military equipment, such as saddles and harnesses, quivers, bowcases and scabbards for swords and daggers.

The few leather objects that have been found in archaeological excavations are of a utilitarian nature, such as shoes, and it is only from the 15th century that decorated leather objects have been preserved in any quantity above ground. Surviving examples from Nasrid Spain and Ottoman Turkey include sumptuously decorated shoes, saddles, quivers, and shields, many with silk, gold and silver embroidery.[2] On several of these artefacts leather served as the foundation for decoration in other materials. Other techniques perfected in the Islamic world were blind and gold tooling: more properly the techniques of the bookbinder, a large, 16th-century Ottoman leather dining-mat provides an impressive example of their use on a household object.[3]

For some reason it has often been assumed that the methods known in the West for producing relief-decorated leather were not exploited in the Islamic world. A group of objects in the Khalili Collection, however, provides compelling evidence not only for the employment of relief decoration on leatherwork by Muslim craftsmen but more particularly allows us to identify an important school working in Khurasan in the late 12th and early 13th centuries.

Foundation-moulded leatherwork

The most informative contributions to the study of leathercraft in the medieval Islamic world were made by Richard Ettinghausen, including an article on foundation-moulded leatherwork.[4] In this technique strips of leather or cord were glued to a wood surface to form the linear elements of the decoration; the whole was then pasted over with a sheet of leather which was worked with a tool so that the patterns made by the leather or cord strips emerged in low relief.

That the technique of foundation-moulded leatherwork was known by at least the 7th century AD is proved by the covers of St Cuthbert's Gospels, which must be earlier than AD 687, the date of the saint's death. Several features of this binding, including the sewing and the character of the leather, indicate a Coptic influence. Muslim bookbinders too must have derived the technique from the Coptic tradition, and later examples are to be found among the 11th-century bookbindings from the Great Mosque in Qayrawan.[5]

Foundation-moulded leatherwork was not restricted to bindings, however: six wood panels, now in the Islamic Museum, Cairo, and dated by Ettinghausen to the first half of the

10th century were, he suggests, intended for wall-decoration or, less likely, for chests.[6]

A related technique was used to decorate a fragmentary lyre-shaped pouch, now in the Walters Art Gallery, Baltimore. Found in Cairo, the piece is generally thought to be Egyptian or Syrian work of the 7th century AD.[7] Its floral design was formed by attaching strings to a backing of coarse linen over which was placed red parchment.

Press-moulds: materials and techniques

A quite different approach to producing relief decoration in leather was to use moulds, which, as described below, made it possible to create colour contrasts between the ground and the areas in relief.

Large-scale wooden moulds and counter-moulds that necessitated the use of a heavy press were used to produce relief-decorated leather hangings in Spain, principally in Córdoba.[8] Although the surviving examples are not earlier than the 15th century, the tradition may date back to the period before the fall of the city to the Christians in 1236. Indeed, Córdoban leather hangings are even commemorated in a Latin poem of about AD 800. Moreover, the Spanish word applied to these hangings is *guadamacil*, derived from the name of the city of Ghadames, in Libya, which was famous for the quality of its leather at least as early as the 12th century.

Whatever the origin of the *guadamacil* technique, the use of other, relatively small-scale stone moulds – carved in intaglio rather than in relief – can now be documented in the eastern Islamic world in the 12th and 13th centuries.

A stone press-mould, now in the Museum of Fine Arts, Boston, was first published by Richard Ettinghausen, who attributed it to Iran and to the early 12th century.[9] Of soft grey stone, it bears a fragmentary design executed in intaglio and consisting of a central roundel within a rectangular frame with a concave lower side. In the top left-hand corner are paired harpies and at the lower left, a winged griffin. Within the frame Arabic prayers are inscribed in negative in *naskh*. The mould is inscribed separately at the left with the maker's name in positive, *Bandar al-Sarrāj* ('Bandar the saddle-maker'). This signature prompted Ettinghausen to suggest that the design might have been for a richly embossed saddle. In any case, the use of the *nisbah* 'the saddle-maker' makes it certain that Bandar's craft was leatherwork.[10]

On the basis of Ettinghausen's identification other stone press-moulds in public and private collections have been identified,[11] and more recently moulds of fired pottery clay bearing designs similar to those on the stone moulds have also come to light.[12]

As the four stone press-moulds in the Khalili Collection demonstrate, the softer stones such as limestone (used for cat.215–17) and talc (cat.218) were generally preferred for ease of handling. The stones are up to 2 centimetres thick and rarely exceed 30 centimetres in length. Both sides of each of the Khalili moulds were carved smooth and in three of the four cases designs were incised on both sides (cat.216–18).

The probable method of press-moulding was to paint the flat surface of the mould with a stain, possibly a tanning substance, which left the background leather a darker brown than the raised pattern.[13] The moulds in the Collection bear designs for decorated leather objects or for *appliqués* in leather or some other material and their intricate details would seem to demand the use of a soft leather such as sheepskin. The leather would first have been thoroughly dampened before being tamped into the incised elements of the mould and possibly subjected to heat to harden it.

Some indication of how such moulds were used is provided by the doublures of many

book covers of the 14th and 15th centuries;[14] indeed, the doublures on the two extant volumes of a 30-part Qur'an in the Collection (QUR433 and 132) are particularly apposite, affording clear proof that the press-moulds catalogued here were used for patterning leather.[15] They are of thin leather – sheepskin tended to be preferred for doublures, as it was softer and suppler than the goatskin generally used for the outer covers – and bear a press-moulded pattern in light relief, the background being darker than the raised elements. The decoration has been obtained by applying a basic block, measuring 11 × 9 centimetres, several times to each doublure with scant regard to direction and precise registration; see fig. 11. Whether the moulds were of stone or wood cannot be determined.

There is a close relationship between the designs on these doublures and those on one of the stone moulds in the Collection, cat. 215(D). On the doublures the design consists of interwoven scrolls about a central axis defined by a frontally presented human head wearing a Turkish hat with three peaks. This is flanked by human heads seen in profile that issue from the scrolls and wear tall pointed hats, the tips of which unite in what may be a bull's head. Each of the surrounding scrolls also ends in the head of an animal – these include elephants, foxes, leopards, dragons, unicorns and hares. It is perhaps surprising that an example of an 'inhabited scroll' came to be included in the decoration of a Qur'an manuscript. The medallion on cat. 215 also consists of a central axis flanked by paired scrolls, each with its inner tendril ending in a human head wearing a tricorn Turkish hat. The outer volutes of the medallion terminate in the heads of real and imaginary animals.

Press-moulds in the Khalili Collection: designs

Some idea of the variety of decorated leather products made with press-moulds is provided by cat. 216 in the Khalili Collection. To judge from the designs on the stone, the workshop that used it manufactured at least three shapes of wallet with different means of closure. Three of these designs (A–C) were intended for the decoration of one wallet, as described in the entry on cat. 216, below. This form of shallow wallet – squareish in shape with concave vertical sides – seems to have been popular, since similar designs occur on another of the moulds, cat. 217, as well as on moulds in other collections.[16] Another design on cat. 216, for the front of a bell-shaped wallet (E),[17] shows the flap incorporated into a single-piece composition instead of being a separate panel. Both of the other designs (D and H) have projecting tabs in place of a broad flap; these would have been inserted into a loop on the other face of the wallet as a fastening. If the loops were on the front of the wallets, any decorative designs for these must have been on a separate press-mould.

Until recently such leather wallets have been known solely from the mould designs, but now actual examples have been acquired for both the Khalili Collection (cat. 214) and the Al-Sabah Collection in Kuwait.[18] Both are exact versions of the wallet design on the first side of cat. 216 (A–C). The leather lacing with which the gussets were sewn to the sides of the front and back panels still survives on cat. 214, which also has an intact flap that indicates the manner of fastening. The flap on the Kuwait specimen is missing but its outline is indicated by a blank section on the front face of the wallet. This treatment of the front is precisely that of the wallet design on cat. 216, where the area to be covered by the flap is left blank except for the designer's signature.

Although it is not possible to define the precise function of such wallets, we can suggest how they might have been carried. In the life-size paintings of Turkish slave guards on the inner wall of the main audience *iwan* of the palace of Mahmud of Ghazna at Lashkari Bazar, each figure wears a type of garb that is generally agreed to have originated among the Turks

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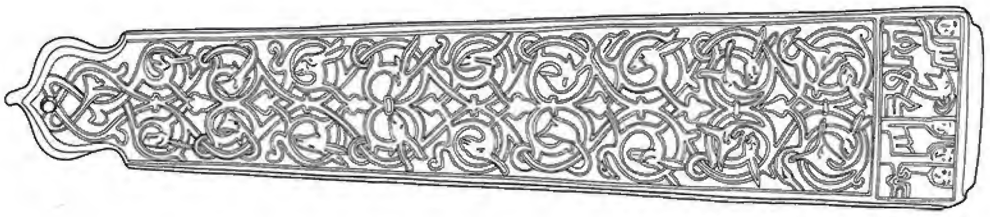
Leather wallet

Khurasan, late 12th or early 13th century

Pale, buff, slightly wormeaten leather, wooden buttons, paper lining, 10.5 × 9.5 × 0.5 cm
accession no. MXD 286

The front, back and flap of the wallet are made from a single piece of leather. The side gussets were cut separately and sewn to the sides of the front and back panels with narrow strips of leather dyed green. To close the wallet, a wooden button attached to the middle of the flap by a leather lace can be caught in a leather loop in the front panel. The ends of the loop run down inside the wallet before emerging at the base, where they are knotted. A lining of thin leather is attached to the inside of the flap and the back panel and another to the inside of the front; the two layers of leather are separated by greyish-white paper, which is visible where the lining has come adrift. Another leather lace with a button terminal passes through the inner lining at the middle of the fold separating the back panel from the flap. This may have been used to suspend the wallet from a belt. The wallet is similar in size and structure to the design on side 1 of the leather press-mould, cat.216.

The leather is comparatively soft. The relief decoration is only faintly visible due to the deterioration of the surface. It is clearest on the back, where a central roundel containing a knot is bordered on the left by a series of volutes each containing a trefoil. In the top left corner a quadruped marches towards the left. There appear to be similar roundels on the front and flap. With the exception of the knotted design within the roundel these motifs are the same as those on the stone moulds.



Lid of a pen box, Khalili Collection, MTW816 (see caption opposite)

Doublures of two sections of a 30-part Qur'an, Anatolia or the Jazirah, 1250–1350; Khalili Collection, QUR433 and QUR132

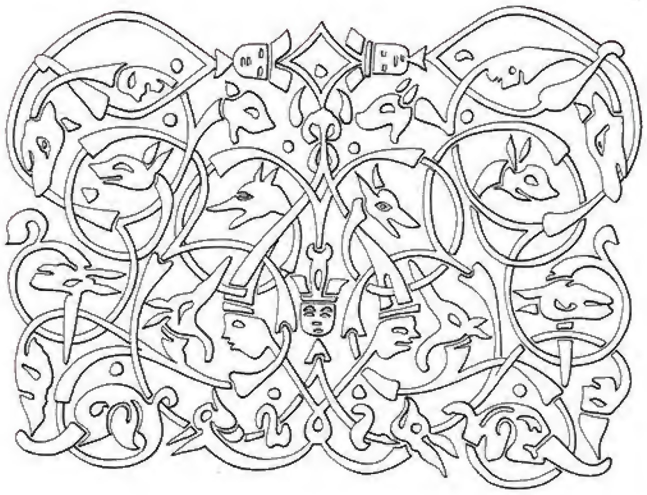


Figure 11 Reconstruction of the design on the block used to press-mould the two doublures shown above

The swivelling lid of a pen box illustrated opposite was made by one Shadhi Naqqash in Khurasan in the late 12th or early 13th century (MTW 816, ex-catalogue). It is of brass inlaid with silver and copper, and measures 17 × 3.5 centimetres. It is decorated with inhabited scrolls in inlaid silver, the necks of the animals being inlaid in copper. The signature, 'the work of Shadhi, designer', is written across the top in human-headed Kufic.

The Khalili Collection also possesses a complete pen box signed by the same maker, of precisely the same form but slightly shorter (MTW821, ex-catalogue). It is decorated with similar inhabited scrolls in inlaid silver. For a complete description, see Fehérvári & Nassar, forthcoming.

of Central Asia – a long kaftan with revers folded across the chest from left to right and a belt with paired scarves hanging to the hem and two or more pendant straps.[19] In one of the better preserved renderings a pouch, probably of leather, in the form of a waisted rectangle and measuring about 18 × 10 centimetres, is shown attached to one of the pendant belt straps.

The significance of the belt as a symbol of office in the medieval Islamic world has long been known, and these 11th-century wall paintings are among the earliest depictions to show how the belt and pouch were worn.[20] A similar pouch can be seen in a late 12th- or early 13th-century carved stone tympanum from Kubacha in Daghestan, where it is also shown as a belt attachment worn by a horseman;[21] see fig.12.

The 'border' designs (F) and (G) on cat.216 may have been intended for the ornamentation of a belt or baldrick, or of the pendant straps to a belt, while the two arrow-shaped designs (I) and (J) may have been *appliqués* for a scabbard.

The largest of the designs are those on cat.218, which may have been intended for the decoration of a quiver. The moulds were probably used to produce leather *appliqués*, as a quiver would have required a stronger material than the sheepskin believed to have been used with such moulds. However, the intaglio cutting on these stones is deeper than on the other examples and may mean that they were used with stouter leather than usual.

While the function of many of the objects to be decorated with these moulds is clear, the kind of aretefact that was produced using cat.215 is uncertain. The composition on this stone does, however, provide an indication of the origin of all these moulds.

Press-moulds in the Khalili Collection: provenance and date

Two principal features in the decoration on cat.215 point to a Khurasani provenance. One is the use of segmental inscribed cartouches with alternating roundels, as on cat.215 (A). Comparable cartouches, usually forming a full circle around a central medallion, occur frequently on a group of brass trays attributable to 12th- and 13th-century Khurasan.[22]

It is possible to find parallels on Khurasani metalwork for almost all of the motifs found on the moulds – fabulous creatures, an enthroned prince with attendant musicians and carousing companions, huntsmen and animals of the chase and a hound pursuing a hare.[23] But it is the 'inhabited scroll' in which the inner tendril terminates in a human, animal or bird head – a motif common to all the moulds – that reinforces a Khurasani attribution.

The inhabited scroll seems to have had its origin in Khurasan and first appears in a marble relief that is possibly from the Palace of Masʿud III (r. 1099–1115) at Ghaznah, although it may be somewhat later in date.[24] Its next appearance in Khurasan is in objects made by the metalworker who signed himself *Shādhi al-naqqāsh* ('Shadhi the designer') or *naqqāsh* and, in one instance, also *al-Harawi* ('of Herat').[25] A fine example of Shadhi's work is a pen box in the Collection, MTW 821 described here, that bears a simplified version of an 'inhabited scroll' found on another pen box by him in the Freer Gallery of Art, Washington, DC. Shadhi's scrolls relate closely to those on the Khalili stone moulds, in particular cat.215 (A) and 216 (H), in their symmetrical disposition of the animal heads, the mirror-imaging of adjacent figures and the use of a strong central axis.

The Freer pen box is dedicated to Majd al-Mulk al-Muzaffar and dated AH 607 (AD 1210–11). This date provides further confirmation of the connection between Shadhi's work and the moulds, for on cat.215 there is an important dedicatory inscription to a Ghurid general and governor of Herat, ʿIzz al-Din Husayn ibn Kharmil, who died in that very year, 1210 or 1211.

The dedication to ʿIzz al-din Kharmil provides a precise date and provenance for this group of moulds, around the last quarter of the 12th and the early 13th century and probably not later than the Mongol invasions. There is good reason to assume that all were made in Khurasan. In the first place, geological evidence supports an attribution to Herat. The limestone of cat. 215 and 216 is found in an east – west belt north of Herat but is unknown elsewhere in the region. The talc of cat. 218 comes from the mountain known as Safed Koh, east of Herat.[26] Secondly, it is known that good leather was available in the region, and, one may presume, leatherworking was well-developed. The anonymous author of the geographical work the *Ḥudūd al-ʿĀlam*, writing in AD 982, tells us that the city of Anbir, now Sar-i pul, capital of the province of Guzganan or Juzjanan, a fertile textile region between Herat and Balkh, 'produced the Guzgan leather [*pust-i gūzgānī*] which was exported all over the world'.[27] Moreover, ʿIzz al-Din Kharmil had his estates in Jurzuwan in the province of Guzganan and it is not impossible that leather was still being produced in Anbir in the early 13th century.

It has long been recognized that the technique of silver-inlaid brasses was developed in Khurasan and then introduced into Iraq and Anatolia, Syria and Egypt in the late 12th and early 13 century. The relief-moulding of leather, which shares many of the metalwork's primary motifs, is yet another proof of the artistic vitality and initiative of the craftsmen of Khurasan, and of their influence on the crafts of the central Islamic lands.

Apart from the moulds themselves, the wallets in the Kuwait and Khalili collections are the only known surviving examples of the application of the technique to leatherwork for domestic or military use. Nevertheless, it seems that the decoration of leather by means of stone press-moulds carved in intaglio was well-developed in Khurasan in the closing years of the 12th century and the beginning of the 13th century. The process next appeared in Anatolia and Iraq in the 14th, if not the 13th, century, when it was applied by bookbinders to doublures, of which the most notable are those in the great Qur'an made for the Ilkhanid ruler Öljeytü in 1306.[28]

Figure 12 Stone tympanum, Daghestan, early 13th century. The horseman wears a leather pouch attached to his belt. Metropolitan Museum, New York, Rogers Fund, inv.no.38.96.

1. Robinson 1967, pp.169–73; London 1976, p.182, no.199; Baer 1983, p.119, fig.98 (showing lid) and p.127, fig.104.
2. For examples in the Topkapı Palace Museum, Istanbul, see Rogers & Ward 1988, p.155, no.95 (a quiver), p.184, no.126 (a casket) and p.155, no.96 (boots with exceptional decoration combining leather *appliqués* with embroidery). For other collections, see Frankfurt 1985, p.355ff., nos II/5 and II/6 (bow case and quivers), p.364, II/23 and II/24 (saddles), p.369, II/34 (a flask), p.370, II/36a and II/36b (a belt with attached wallets and ammunition case); Dodds 1992, no.64 (an embroidered belt and pouch), and no.66 (an embroidered *adarga*, from the Arabic *al-darqah*, shield, from Nasrid Spain). For relief-decorated leather boots in a miniature from Dioscorides, see Munich 1910, I, taf.4; Martin 1912, II, pl.6b
3. Museo Nazionale Ravenna; Venice 1993, pp.398–40, no.248. Probably intended for military use it is decorated with gold-tooled inscriptions and decorative patterns.
4. Ettinghausen 1965a.
5. Ettinghausen 1965a, p.68, fig.10; Ettinghausen 1959, p.116, fig.B; London 1976, p.319, fig.507.
6. Ettinghausen 1965a, pp.64–7, figs 1–9.
7. London 1976, p.71, fig.12; Ettinghausen 1959, p.2, fig.4; Ettinghausen 1965a, p.71, fig.12.
8. Waterer 1972.
9. Ettinghausen 1954, fig.359.
10. Another occurrence of this description is the signature of Muhammad ibn al-Sarraj on a chest decoration in ivory intarsia in the Museo Arqueológico Nacional, Madrid; Ferrandis 1940, pp.258ff.
11. For a fragmentary mould in the Museum of Fine Arts, Boston, see Ettinghausen 1954, fig.359; for another in the Art Institute of Chicago, see Ettinghausen 1954, figs on p.473; for a fragmentary mould from Afrasiyab (Samarqand), see Rempel 1978, p.76 and fig.36; two stone moulds sold at Bonham's, London, 27 April 1994, lot no.100. A double-sided mould in the Al-Sabah Collection, Kuwait, inv. no.LNS 108 S, is unpublished.
12. There are five pottery moulds in the Al-Sabah Collection, Kuwait: inv. no.LNS 644 C is certainly a leather press-mould and carries the design for the back of a wallet of the same type as cat.216 (E), below; inv. no.LNS 649 C has a border design of paired quadrupeds, dragons and female dancers on a scrolling ground which tapers slightly upwards and could well be a design for a strap; the remaining three may be leather press-moulds or press-moulds for stucco. These pottery moulds must have been prepared from wood or stone matrices and so would have had a wider circulation than those made of stone.
13. Bosch, Carswell & Petherbridge 1981, pp.65ff.
14. Raby & Tanındı 1993, pp.9–10.
15. James 1992, p.197, no.48.
16. For references, see cat.216, below, note 2.
17. For references, see cat.216, below, note 3.
18. Inv. no.LNS 21 L.
19. Sourdel-Thomine & Spuler 1973, pl.XL (colour); Schlumberger *et al.* 1978, pls 120–24, pp.61–4.
20. The form differs little from the Ottoman pouch and that from Nasrid Spain referred to in note 2, above.
21. Dimand 1938, pp.260, 262.
22. Melikian-Chirvani 1982, p.145, fig.51.
23. Pope 1938–9, pl.1308; Sourdel-Thomine & Spuler 1973. Such themes were appearing in Herati metalwork as early as AH 550 (AD 1163) where, according to its inscription, the so-called Bobrinsky bucket, now in the Hermitage Museum, St Petersburg, was made. Two moulds in other collections illustrate the story of Bahram Gur and Azadeh. One is the fragmentary mould from Afrasiyab (see note 11, above), the other the wallet back design sold at Bonhams 1994, lot no.100 (see cat.216, below).
24. Bombaci 1959, p.13ff. and figs 11, 12; *Encyclopaedia of World Art* 1962, VI, pl.164; Baer 1965, p.66, pl.XLVII, figs 82, 83.
25. Shadhi's signature appears on five items. For a pen box in the Freer Gallery of Art, Washington, DC, see Herzfeld 1936; Pope 1938–9, p.2511 and figs 841a, b; Atıl, Chase & Jett 1985, no.14, pp.102–10; and Melikian-Chirvani 1982, p.72. For the pen box in the Naqshbandi Foundation, Herat, see Melikian-Chirvani 1982, pp.69ff and figs 40, 41 and Atıl, Chase & Jett 1985, fig.40. For a pen box and the swivel-top to another pen box, both in the Khalili Collection, see pp.343–44, above. For the small, bird-shaped flask bearing the signature of Shadhi with the addition *al-Harawi*, see Melikian-Chirvani 1982, p.72; Atıl, Chase & Jett 1985, p.106, fig.41.
26. I am indebted for this valuable information to Mr Wak Kani, Fellow of the Geological Society, who writes, 'According to the *Geology of Afghanistan*, Berlin, 1977, p.419, the talc mould must be from the eastern or northern Safed Koh 120 kilometres east of Herat. This area contains the only known outcrop of talc in Afghanistan.

'The two limestone moulds are likewise of Herati origin. The thickest limestones of the geological succession of Afghanistan are Middle Carboniferous and Upper Permian, the latter being described as a black limestone. Outcrops of these formations occur in an east – west belt north of Herat.

'It is noteworthy that limestones are not known in the vicinity of Merv.'
27. *Ḥudūd al-ʿĀlam*, p.107.
28. For doublures of the 13th to 14th century, see Bosch, Carswell & Petherbridge 1981. For Öljeytü's Qur'an, see Raby & Tanındı 1993, p.9.

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Press-mould

Khurasan, *circa* 1206–11

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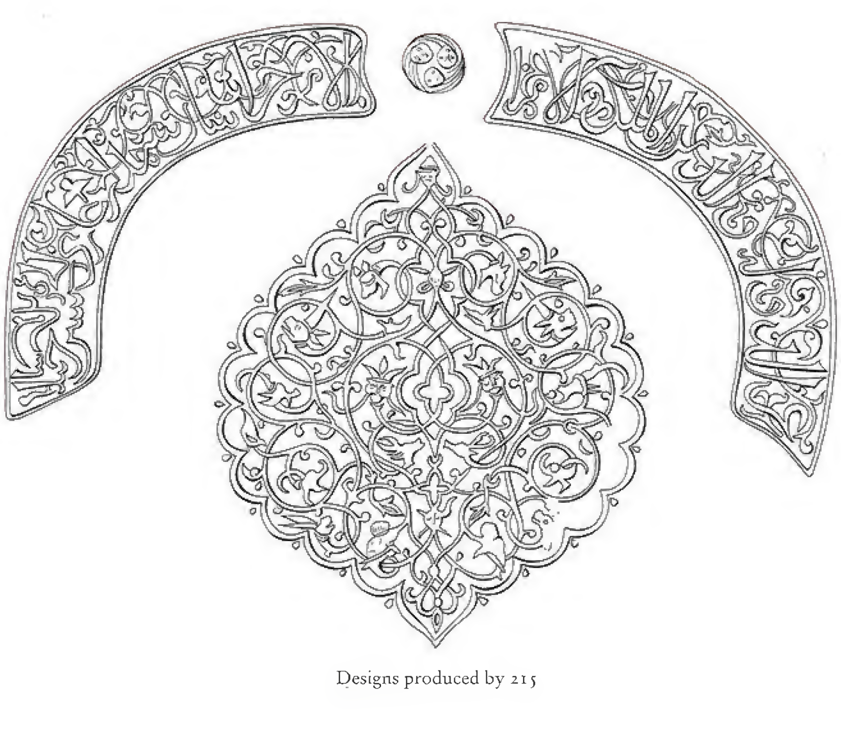

Designs produced by 215

Limestone, carved and incised,
16.3 × 15 × 1.9 cm
accession no. MXD17

This mould is of especial importance within the group, because it bears an inscription in the name of a Ghurid governor of Herat who died in 1210 or 1211. It therefore provides documentary evidence to support an attribution of these moulds to early 13th-century Khurasan.

Four decorative designs have been cut into the stone, on one side only: two segmental cartouches (A, B), a tiny roundel (C) and a polylobed medallion (D).[1]

The cartouches were intended as a pair as they contain two parts of a dedicatory inscription in Arabic, written in *naskh* against a scrolling ground. The inscription begins in the lower cartouche and when placed side by side the *cyma recta* of each marks the beginning and end of the inscription. This is in the name of Malik ʿIzz al-Din Husayn ibn Kharmil, who played an important part in the final years of the Ghurid dynasty.[2] His father had won renown at the battle of Zamindawar, where the fate of the Ghaznavids was decided.[3] The son was in the service of Sultan Muʿizz al-Din (r. 1173–1203), who, returning from a successful expedition against Lahore, appointed him governor of the castle of Sialkot.[4] His story is one of repeated acts of perfidy. Returning from an abortive expedition to capture the Khwarazm Shah's capital, Sultan Muʿizz al-Din was faced with an opposing force of the Khitai. Ibn Kharmil, who commanded the van, advised the Sultan to engage the enemy but then, under cover of darkness, withdrew with his troops to his estates in Jurzuwan, leaving his sovereign to fight alone.[5] Subsequently he served Sultan Ghiyath al-Din Mahmud, Ghurid successor of Muʿizz al-Din (r. 1206–1212). Appointed governor of Herat, he was active in the negotiations between Sultan Ghiyath al-Din Mahmud and ʿAla al-Din Muhammad Khwarazm Shah, serving the interests now of the one and now of the other until, his treachery exposed, he was executed at the orders of the Khwarazm Shah, probably in 1210 or 1211.[6] The press-mould must have been made between his appointment to the governorship of Herat and his death.

The roundel (C) contains three human faces, the hair arranged in a whorl, and was designed to be placed between the semicircular ends of the inscription bands.

The top of the polylobed medallion is directed towards the lower left-hand corner of the stone, as is indicated by the tiny human head with cap and side curls set within the ogival tip. Within the medallion a central quatrefoil figure formed by four volute scrolls is framed by ten smaller scrolls. Each of the two larger central volutes terminates in a human head,

shown full face, wearing a three-pointed crown and with puffed-out cheeks, of a type that can be seen on a well-known form of bronze mirror.[7] The head-dress is probably a hat of felt rather than a crown pertaining to sovereignty. The two lower volutes each end in the head of a gazelle and the outer volutes also end in different types of zoomorphic heads – unicorns, hares and an elephant, for example. Except for the elephant, each volute on one side is paired with its opposite on the other side, so that the animal heads are mirrored across the vertical axis.

There is no means of knowing precisely for what these designs were intended or indeed if they were meant for a single assemblage. In a silver-inlaid bronze tray made in Khurasan in the first half of the 13th century, now in the Musée du Louvre, Paris, five inscribed segmental cartouches alternate with decorated roundels forming a complete circle about a central medallion;[8] this might suggest that the mould was intended to produce a leather tray with a comparable composition, but the diameter of the half circle formed by (A) and (B) here is too small to accommodate the medallion.

1. The outer profile of each segmental cartouche (A, B) is 14 cm across; the roundel (C) is 1.5 cm in diameter; and the medallion (D) is 12.8 cm in length.
2. The Arabic of the inscription is faulty, but the title commander-in-chief (*amīr al-umarā'*) and commander of the army (*sipāhdār*) of Khurasan seem to be intended.
3. Juzjani–Raverty 1881, p.351; Juzjani, p.342ff.
4. Juzjani–Raverty 1881, p.353; Juzjani, p.397, 398. Juzjani lists him under the Maliks of Sultan Mu'izz al-Din; see Juzjani–Raverty 1881, p.490; Juzjani, p.405.
5. Juzjani–Raverty 1881, p.474, 475; Juzjani, p.402.
6. Juzjani–Raverty 1881, pp.257, 258, n.2 and p.259, n.3 have useful comments on Juzjani's version of these events; and p.400, n.3 discusses the date of Ibn Kharmil's death.
7. Melikian-Chirvani 1982, p.230, figs 105, 106.
8. Melikian-Chirvani 1982, p.145, fig.51.

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Press-mould

Khurasan, late 12th or early 13th century

Dark grey limestone, carved and incised, 29.8 × 26.5 × 1.7 cm (maximum dimensions)
Signed by Muhammad ibn Yusuf
accession no. MXD 97

This mould comprises designs for three wallets, of differing shape and construction, and therefore gives a good impression of the variety of fashion in Khurasani leatherwork in the late 12th and early 13th centuries.

Side 1

On the right of the stone are three designs for the decoration of a single leather wallet (A–C).[1] Each element has a framing band inscribed in *naskh* with a blessing in Arabic, and a main field in which foliate scrolls spiral about a central axis in the form of a full palmette within a rhombus. The longest version of the blessing, that on the back, reads, 'Glory, good fortune, prosperity, health, well-being, happiness, success, grace and long life to its owner'. This is followed by the phrase *'amal Muḥammad* ('the work of Muhammad'). The upper part of the front (A) is inscribed in *naskh* with the maker's full name, *'amal Muḥammad ibn Yūsuf*.

A single piece of leather had simply to be laid over the design panels and, after tamping and trimming off, folded so that the flap at the bottom of panel (C) fitted neatly over the undecorated section at the top of panel (A). This panel would form the front of the wallet, while the middle panel (B) formed the back. This is why the designs on the back (B) and flap (C) are upside-down in relation to the front.[2] The sides were then stitched together. The depth of the wallet, that is the gusset, was determined by the distance between each of the design panels, an area indicated by lightly incised hatched lines on the mould.

It is hard to explain why the framing inscription of the flap is written in positive, so that when transferred to the leather it would have appeared in negative. To produce a positive version, the leather would have had to be reversed before moulding but the text would have appeared not in relief but in intaglio. It is most likely that this was a mistake on the part of Muhammad ibn Yusuf. Indeed, he does not seem to have been overly concerned with the accuracy of the inscriptions: that on the front is preceded by a few letters that are both positive and upside-down to the remainder of the inscription, which is given correctly in negative.

On the left of the stone there are two further designs, both with a bell-like profile.[3] The upper design (D) contains a quatrefoil within which are paired birds above a figure seated on a lotus throne between two attendants, each holding a goblet.[4] In the spandrels of the design, paired quadrupeds (perhaps unicorns above and mountain goats below) stand on a ground of foliate scrolls, with birds between. On the projecting tab a plant is shown upside-down in relation to the main composition.

The upper part of the lower design (E) shows the decoration for a flap, demarcated by an ogival double border, which indicates that the lower part must show the front of a wallet. The flap may have been pressed separately on a different piece of leather or else cut out around the lower edge of the border and the relief-moulded leather sewn onto a pouch made of leather or another material. The two sections of the design – front and flap – have a central quatrefoil with a figure seated on a lotus throne, as on (D), but here the superposed birds and the attendants are missing. Above the quatrefoil on the flap there are paired sphinxes each wearing a three-pointed crown; below the quatrefoil there are paired birds. On the front the most prominent feature is a pair of ferocious dragons with wide-open jaws that leave the two sphinxes below looking relatively benign.

The two designs (D) and (E) can hardly be for the same object as they differ in size, but both were surely for wallets. The fact that the plant on the tab of (D) is upside-down in relation to the main field may mean that the projection was a tongue intended to fit into a loop on the other face of the wallet.

Side 2

The second side consists of five separate designs.[5] Along the bottom edge there is a border design (F) consisting of a four-stranded guilloche that forms two series of cartouches, smaller within larger. The strands are punctuated by tendrils and split palmettes. The shape and length of the design suggests that it might have been suitable decoration for a shoulder strap. To the left, a fragment of another running design (G), perhaps for a belt, contains a line of four fabulous beasts, all winged quadrupeds, processing from left to right against a ground of foliate spirals. The first of the beasts has a dragon's head, the second a bird's head, and the third and fourth (now mostly lost) had a human face aureoled with rays and the head of a feline respectively.[6]

In the centre of the stone is a design with five concave sides and a heart-shaped projection at the top (H). Within a broad border containing blessings in Arabic inscribed in foliated Kufic, an arabesque forms six pairs of volutes about a central axis in which the stem forms three quatrefoils. Each volute terminates in an animal mask: paired goat masks between paired dragon's heads and lion masks. In the projection there are dragon heads within scrolling volutes. The blessing, which wishes the owner glory, good fortune, prosperity, and health, begins in the corner to the left of the projection, but it is not possible to tell which way up the design is meant to be read. It suggest a florid version of the *tabula ansata*, a familiar feature in Qur'anic illumination, but is more likely another variety of wallet decoration.

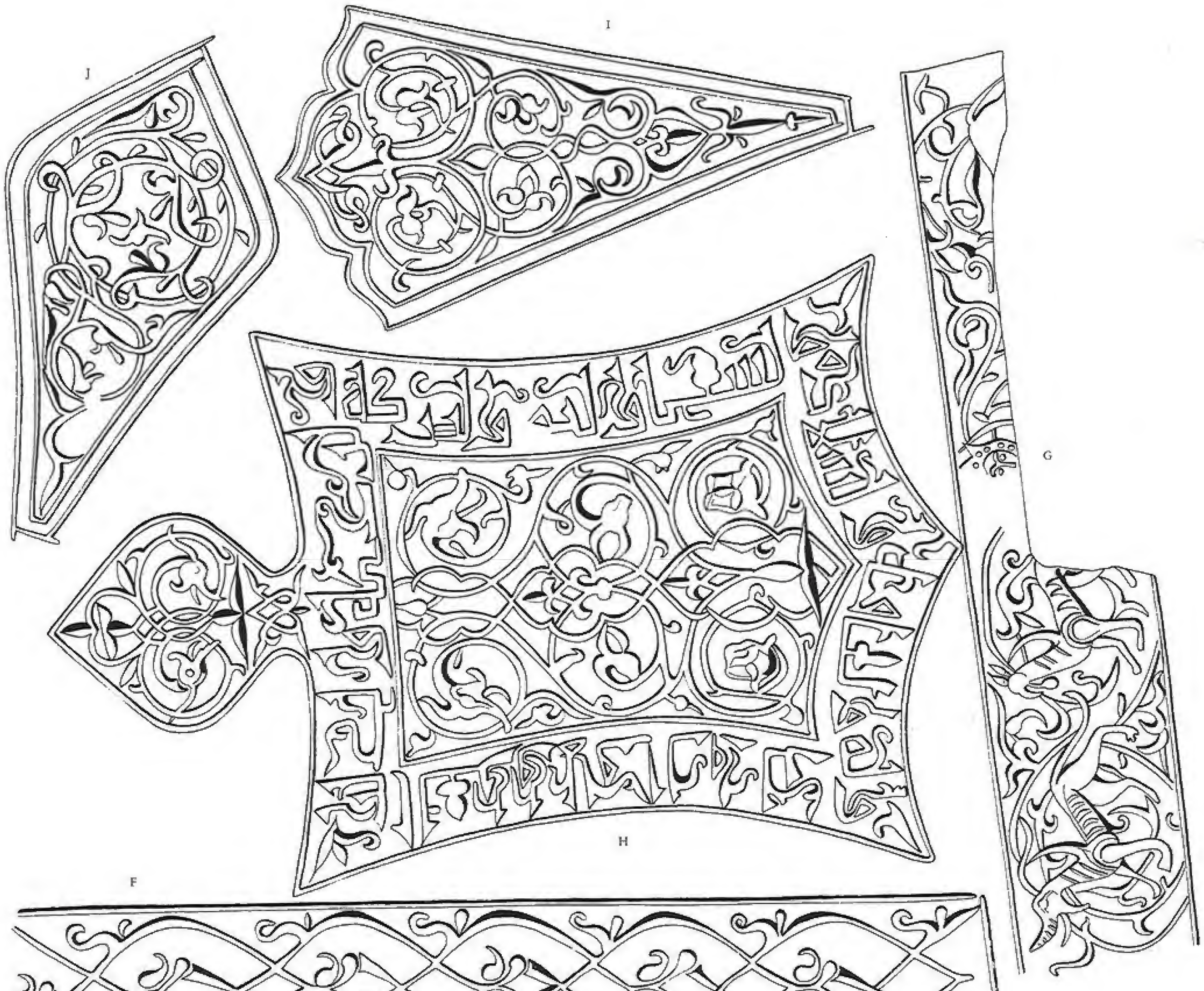
At the top of the stone there are two smaller designs that are approximately the shape of arrowheads and may have been intended as scabbard adornments. If for a dagger scabbard, later practice suggests that they would have been folded in half in order to decorate both sides of the scabbard point. The larger design (I) is decorated with foliate scrolls, the smaller (J) with a single scroll drawn rather summarily, and each has a double border line.

1. The front (A) measures 9 × 10 cm; the back (B) 9 × 9. 8 cm; and the flap (C) 8.8 × 4.5 cm.
2. For other designs for this type of wallet, see one offered for sale at Bonhams, London, 27 April 1994, lot no.100, with one design for the front and back and another for the front only; cat.217, below; Rempel 1978, p.76 and pl.36, for a fragment of a back; and another in a private collection, London. An extant leather wallet of this type is in the Al-Sabah Collection, Kuwait, inv. no.LNS 21 L.
3. For another example of a stone mould design for the bell-shaped wallet, see that sold at Bonhams in note 2, above. There is an example of a pottery mould for a design for a wallet back only in the Al-Sabah Collection, Kuwait, inv. no.LNS 644 C.
4. Design (D) is 10 cm high.
5. Design (F) measures 3.4 × 19 cm; (G) 3.4 × 19 cm; (H) 17 × 11 cm. Designs (I) and (J) are 11.3 cm and 9.5 cm long respectively.
6. A human face, entirely rayed, between flying angels can be seen at the top of a remarkable composition on a steatite mould in the Al-Sabah Collection, Kuwait, inv. no.LNS 108 S, side 1. The signs of the zodiac within a central roundel suggest that the sun symbol was intended here.

Designs produced by 216, side 1

216, side 1

216, side 2



Designs produced by 216, side 2

217

Fragmentary press-mould

Khurasan, late 12th or early 13th century

Limestone, carved and incised, 8.5 × 9.4 × 1.3 cm
accession no. MXD 20

Side 1
This side bears designs for the flap of a wallet and the upper part of the back.[1] In the centre of the flap is a quatrefoil within which is a seated figure between two attendants – a harpist and a man holding a flask in one hand while his other, raised, arm bears a bowl of fruit. There is a third figure kneeling in front. Each of the spandrels contains a horse and rider and, below, a hare. Below this flap design is the upper part of the design for the back of the wallet, which is similar in outline to the back design on cat.216 (E). In the main field part of a large roundel filled with spiral scrolls is visible.

Because the decoration of the flap is in a contrary direction to that of the back, these two designs may have been intended for ornament on a single assemblage, as on cat.216 (A–C).

Side 2
This design is either for the front or back of a wallet, though it does not appear to be related to the two designs on the first side.[2] Rather more than half of the design is preserved on this fragmentary mould.

In accordance with the usual wallet format, the sides are concave. The overall ground is of spiral scrolls of varying size, rather carelessly arranged. In the centre is a lozenge figure with a knot motif at each angle. Of the paired horsemen in the upper part of the design, the one on the left is shooting an arrow, the one on the right has a falcon behind him. What appears to be the outline of a flap has been drawn across the design in a manner that is difficult to explain. The whole design was weakly executed and is possibly unfinished.

1. The flap is 8.2 cm wide and the upper part of the back 8.5 cm wide.
2. The design is 9 cm wide.


217, side 1


217, side 2

218

Press-mould

Khurasan, late 12th or early 13th century

Talc (steatite), carved and incised, 15.8 × 24 × 1.5 cm
accession no. MXD246

With a computed overall height of just under 36 centimetres, the designs on this mould would have fitted well a quiver of cylindrical or rectangular form rather than the triangular type which, judging from Persian miniatures, seems to have been introduced by the Mongols.

Side 1
About two thirds of this vertical design have been preserved, including most of the central roundel and all of the design that fills the lower section.[1] The design in the lower sections shows a 'Tree of Life' between confronted fabulous beasts. The 'tree' consists of a long staff with a lotus flower in the middle and at either end. The creatures flanking it cannot be identified precisely: they are both quadrupeds with wings, a long neck, horns, open jaws and a long, protruding tongue, and they wear collars. Their horns and tails are continued in the scrolls that fill the rest of the space. In the case of the horns one of the scrolls terminates in a dragon's head. In spite of the damage to its head, the animal in the central roundel is easily identified as a lion.

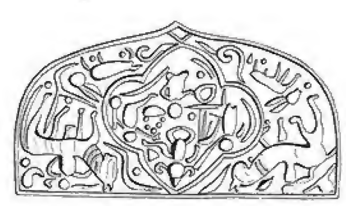
Side 2
This design is slightly larger than that on the first side,[2] and is arranged horizontally, but the dimensions of the two are sufficiently close to suggest that they were intended to decorate a single object.

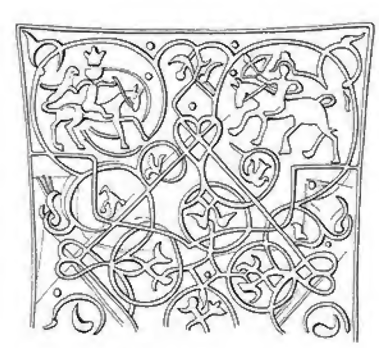
Within the inner cartouche a blessing in Arabic is inscribed in an elegant foliated Kufic, *bi'l-yumn wa'l-barakah wa'l-salāmah wa'l-...* ('in good fortune and blessing and well-being and...'). In the broad surrounding frame a hound pursues a hare in a continuous procession which moves in an anti-clockwise direction above the cartouche and clockwise and upside-down below it. Compared with the designs on the other moulds in the Collection the rendering of the animals is exceptionally spirited.

The palmettes and half-palmettes of the scrollwork in both sections are particularly well-executed and, like the animals, are rendered in higher relief than in any of the other moulds in the Khalili Collection. In addition to the deeper carving there has been much use of a drill to emphasize tendril ends and wing tips, quite apart from the centre points of arcs and circles.

It has been questioned whether this design was intended for leather decoration because of the exceptionally high relief of the impression, and it would certainly not have been suitable for the thin, soft leather used for the other press-mould designs. If it was indeed intended for leather then the finished piece – probably of a stouter material such as goatskin – could have been stiffened by subjecting it to heat, as in a process known in the West which may also have been employed in the Islamic world.

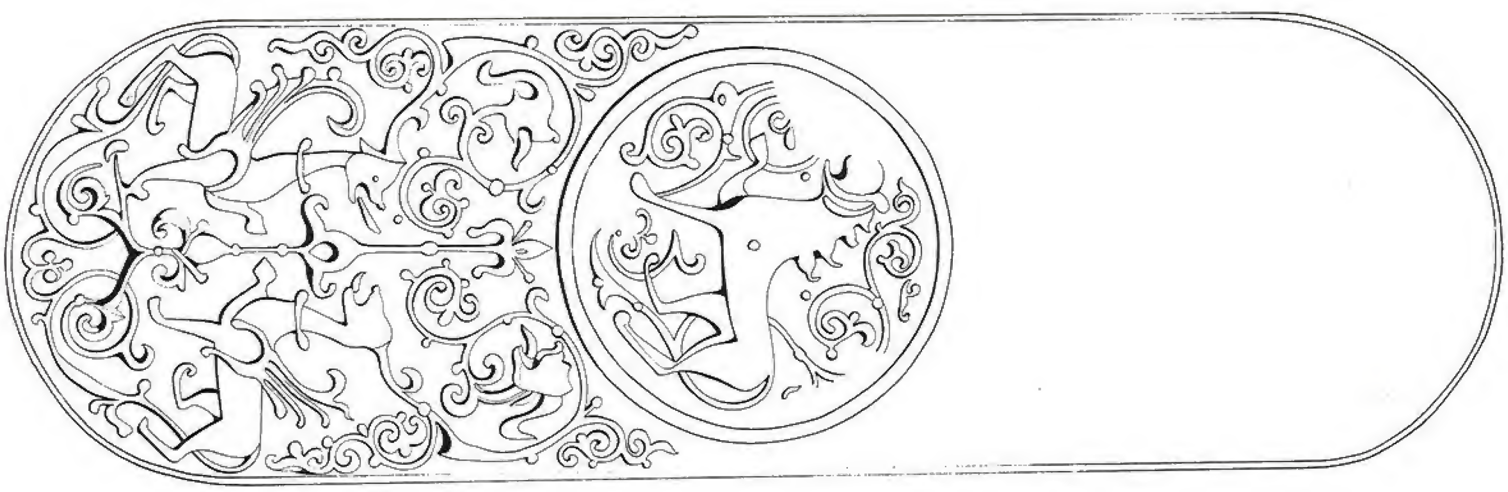
1. The design is 10.9 cm wide, and its total height can be computed to have been 35.8 cm.
2. The design is 12.1 cm high. There is no infallible way of computing the length but it seems reasonable to assume, despite the marginal difference in width due to the wider framing band on side 2, that both designs are of the same length.


Design produced by 217, side 1

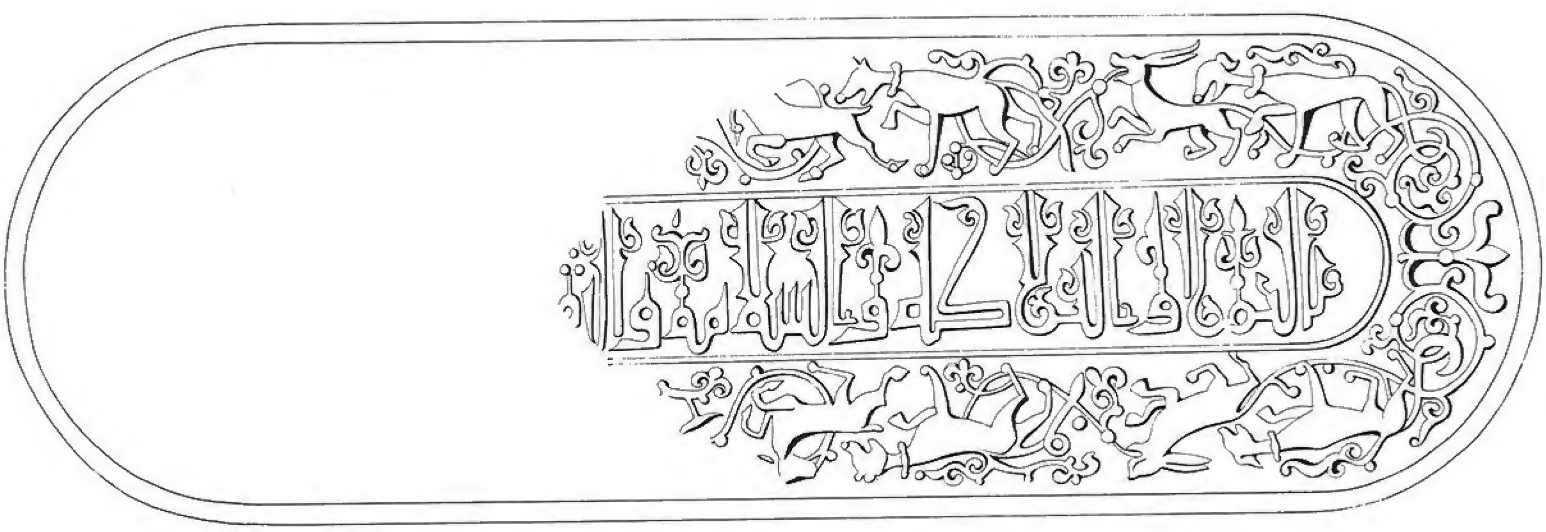

Design produced by 217, side 2

218, side 1

218, side 2



Design produced by 218, side 1



Design produced by 218, side 2

Locks, padlocks and tools

by Tim Stanley

The large and varied group of padlocks published here represent a utilitarian object but one that holds a special place in the traditional culture of the Islamic world, especially that of Iran. Since their invention in remote antiquity locks have been used to secure valuables from theft and to exclude outsiders from domestic buildings, sanctuaries and the like. Muslims, too, used locks to protect sacred precincts from defilement, and in the case of the Ka'bah in Mecca the padlocks supplied by a series of Mamluk and Ottoman rulers of the 15th–17th centuries have been preserved as holy relics in the Topkapı Palace in Istanbul.[1] Also kept there are a number of keys for Ka'bah locks from earlier periods, including several from the 12th and 13th centuries, when it was still the duty of the Abbasid caliphs to supply the Ka'bah with its trappings.[2]

The surviving Ka'bah locks are of various shapes, but they all have a barbed-spring mechanism (compare cat.219–35, 237–65). This type of padlock has a detachable locking-piece or bolt, which is equipped with one or more sets of barbed springs. As the locking-piece is pushed into the body of the lock, the barbs are depressed, allowing them to enter the body through a narrow hole or holes at one end. Once they are in place, the barbs spread out, preventing the withdrawal of the locking-piece. The key, which is inserted from the other end of the body, is designed to flatten the barbs and push the locking-piece out of the body.[3]

Locks of this type were also employed in Shi'i shrines in Iran and elsewhere. The form used (see cat.220–27) has a horizontal body parallel to the long shackle, which is straight for most of its length but curves round at the ends to meet the body. Like the Ka'bah, the tombs of the Shi'i imams and their descendants are believed to emanate a God-given grace, or *barakah*, and it is to benefit from this grace that the devout make pilgrimages to such shrines. As the locks are closely associated with the holy places they protect, they acquire a share of the *barakah*, and pilgrims grasp them as they pass or pour water over them so that they can carry some of the *barakah* away with them.[4]

The special role of locks on these occasions is also due to their symbolic function, as a sign of the 'closing' of an agreement between two parties. In this case the agreement is the pilgrim's vow to perform a pious act if a wish is granted by an imam or other intercessor. For the same reason small padlocks of all types are used in Iran as ex-votos, as are small strips of cloth torn from clothing. To record the vow the supplicant closes a lock or ties a strip of cloth around part of a sacred place, such as the grill in front of a tomb or the chain that hangs down in a mosque doorway. The grills of public fountains (*saqqākhānah*s) are also used in this way, because of their association with 'Abbas ibn 'Ali, a hero of the battle of Karbala', who is considered particularly effective as an intercessor.[5]

The ceremonies performed by Shi'is during the first ten days of Muharram, to commemorate the death of Imam Husayn at the battle of Karbala', are also taken as an opportunity to make vows, and in this case the locks and other ex-votos are attached to the standards carried in the processions or to the *nakhl*, the wooden grill that is carried in some regions as a symbolic image of the coffin of Imam Husayn. Mortification of the flesh also plays an important part in these mourning ceremonies, and padlocks have been used for this purpose, too, threaded through holes made in the participants' chests.[6]

Locks could also be given an apotropaic function, as is shown by examples such as cat.287 and 289 below, which are inscribed with magic formulas. Cat.219 is engraved with similar formulas on one side of the body and on both sides of the semicircular shackle, while the body is also engraved with a particularly relevant verse of the surah *Yā'-sīn*.

The various non-utilitarian, religiously significant functions given to locks in Iran have led to the study of these artefacts as items of ethnographic interest and the creation of a

219

Padlock with a barbed-spring mechanism

Iran, AH 1299 (AD 1881–2)

Steel, forged and cast, 10.1 × 14.4 cm, with engraved inscriptions, the key 16.5 × 4.5 cm
accession no. SCI131

The lock is inscribed with a series of texts in Arabic, which include invocations, a Qur'anic quotation, magic formulas, and the date. On one side of the body there are three invocations in a large, *thulth*-type hand – *Yā Qāḍī al-ḥājāt* ('O Meeter of Needs!'), *Yā Mīzān al-barakāt* ('O Weighing-scale of Blessings!'), and *Yā Rafī' al-darajāt* ('O Exalted of Rank!') – above a line of text in a smaller, *naskh* hand.[1] This contains a very pertinent verse from surah *Yā'-sīn* – 'And We have put a bar in front of them and a bar behind them, and further We have covered them up so that they cannot see' (XXXVI, verse 9) – and the date (see fig.15).

On the reverse there are two lines in a script closer to *nasta'līq*. The first line begins and ends with an asterisk, with four invocations between. The first three contain obscure names, while the fourth reads, *Yā Allāh al-Maḥmūd fī kull fa'ālihi* ('O God, Worthy of praise for all His deeds!'). The second line consists of series of symbolic letters and invocations, including, for example, the group of five letters, /k h y ' ṣ /, that occur at the beginning of the surah *Maryam* (XIX). Below it the number 9 is repeated six times and arranged in a triangle (see fig.16). The shackle is inscribed on both sides with similar sequences.

The use of *naskh* for the Qur'anic quotation and *nasta'līq* for other texts is typical of Iran, but the inscriptions have no Shi'i content, which is unusual for that country at this date.

The barbed-spring mechanism is complex.[2] Both ends of the pipe-like body are closed off by caps. The cap near the free end of the shackle (on the left in the illustration) forms a locking-piece and is furnished with two horizontal prongs. The lower prong is equipped with barbed springs, while the one above it passes through a hole in the free end of the shackle and secures it. Both the prongs also pass through an H-shaped plate set 3.5 cm into the body – it is this plate which engages the barbed spring. A pin fixed to the far side of the plate runs the rest of the length of the body (about 10.5 cm), and at the far end it is surrounded by a broad helical thread (see fig.13): the key has a hollow bit with an external helical screw in order to accommodate these two features.

But the key cannot be used until the second cap has been removed. The cap is fixed to a short (4 cm), hollow helical screw and has a pair of indentations on the outside, which are matched by two projections on one side of the handle of the key; once the projections are engaged with the indentations, the key is turned anti-clockwise to draw out the cap.

The key is then screwed into the body until it can be pushed towards the plate. At this point two grooves on the bit engage with the prongs on the locking-piece, and the locking-piece is expelled from the lock, freeing the shackle (see fig.14).

1. The third invocation appears to be an error for *Yā Rāfi' al-darajāt* ('O Exalter of Ranks!')
2. *Cf.* Wulff 1966, p.71, figs 107, 108; Tanavoli & Wertime 1976, pp.45, 47, fig.30.

219

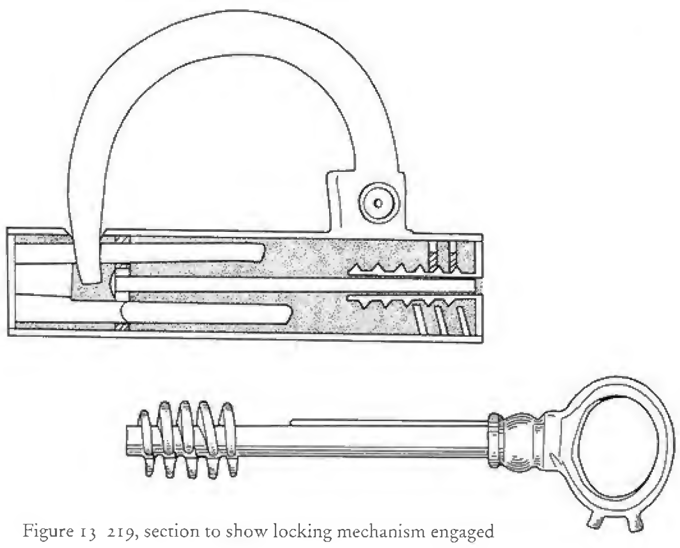


Figure 13 219, section to show locking mechanism engaged

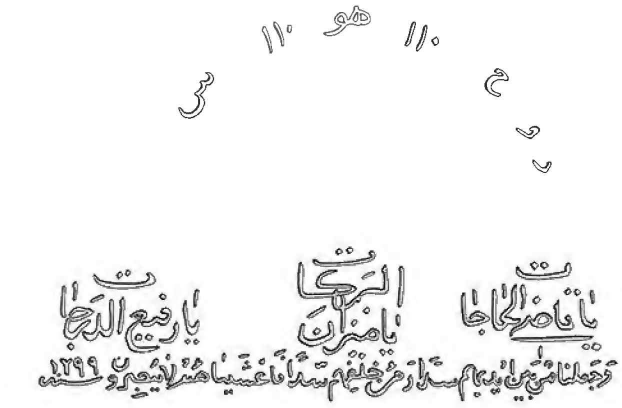


Figure 15 219, inscriptions on side 1

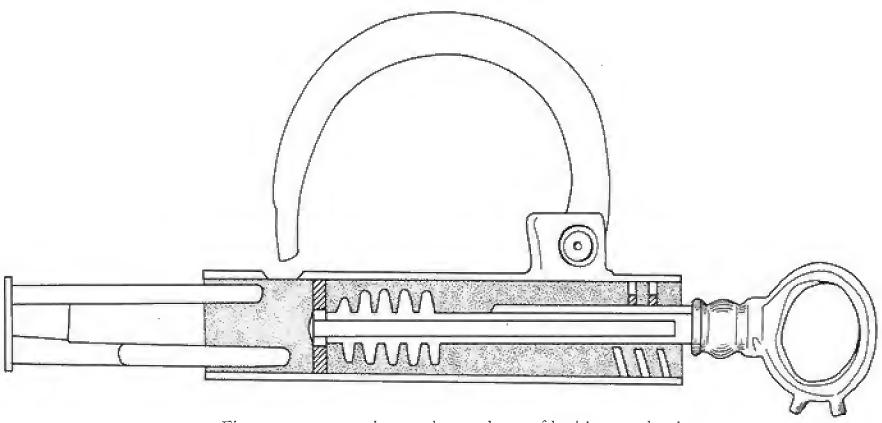


Figure 14 219, section to show release of locking mechanism

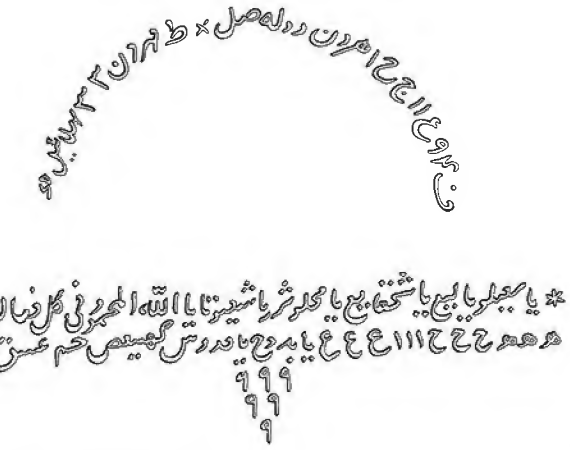


Figure 16 219, inscriptions on side 2

number of important collections. Many of the padlocks collected in Iran were not of local manufacture, however, as the Iranian market attracted imports from China, India, Europe and elsewhere.[7]

During the 19th century European locks seem to have acquired a certain cachet in Iran, and in India, for local imitations were produced, with European-style inscriptions that are often abbreviated or corrupt. Cat.343 below may be an example of this type. Despite foreign competition lock production on traditional lines continued in Iran well into the 20th century, especially in small provincial centres such as Karand (see cat.339–42) and Chal Shutur (see cat.326–9).

For the reasons already outlined there is a preponderance of padlocks from Iran among the holdings of this category in the Khalili Collection, but the pieces catalogued here come from a vast area stretching from Morocco to India. They include examples with bent-spring (cat.268–306), helical-spring (cat.236, 307–329), notched-shackle (cat.331), shackle-spring (cat.332) and combination mechanisms (cat.333–343; see also cat.344), as well as the barbed-spring mechanism described above. They also include a great variety of shapes. Some padlocks have forms that were probably determined by their function, but others are ornamental (see the heart-shaped padlocks, cat.276, 287–90, for example), while yet others are zoomorphic. These last come in the form of fish (cat.230, 280, 281, and the lock cat.266), lions (cat.238, 239, 240–47, 268–71, 318), horses (cat.248, 251, 255–9, 263–5, 267),

birds (cat.254, 273, 278), a hare (cat.252), goats (cat.260, 274) and various unidentified quadrupeds (cat.249, 250, 253, 261, 262).

Tools

The padlocks in the Khalili Collection have been discussed here primarily in the context of non-utilitarian functions specific to Iran, but in other ways – in the type of mechanisms employed, for example, the padlocks form part of a stable tradition of toolmaking that encompasses most of the Old World and reaches back to remote antiquity.[8] At this technological level political events and changes of religion had little effect.

A similar degree of stability may also be observed in other tools in the Collection. The shears cat.375, for example, have parallels from a place and time as remote as Roman Britain,[9] and implements of this type are still widely used in the Middle East. The overlaid silver ornament, though, marks these shears out as Indian work, and in general it is the decorative elements that betray the origin of all the pieces catalogued here.

The forms of the leatherworker's tools cat.361 and cat.376 can also be traced back over thousands of years, although the paring knife, cat.376, is an exquisite version of the prototype. There is good evidence that it was produced in the mid-17th century by a smith associated with the Safavid court in Isfahan, where steelmaking reached an unusual degree of refinement. Later examples of such work are the scissors cat.353 and 354.

Fine steelmaking can also be observed in the Ottoman paper scissors, cat.345–9, the production of which J.M. Rogers has recently associated with the town of Foča in Bosnia.[10] Their history is not well-known, but their production seems to have resisted competition from foreign industrial products for some time. This may have been because their hollow-ground blades gave them a technical advantage, as it made them easier to keep sharp, but their manufacture may also have been sustained by their role in calligraphy, an art that remained unsullied by infidel influences.

1. Sourdel-Thomine 1971, nos 13–21; for colour reproductions, see, for example, Akşit 1986, p.177, no.8; Atıl 1987, p.125, no.55.
2. Sourdel-Thomine 1971, nos 1–12. These keys may have been sent to Istanbul as an acknowledgement of the suzerainty of Sultan Selim I after his conquest of the Mamluk empire in 1516–17; Sourdel-Thomine 1971, pp.41–2.
3. Tanavoli & Wertime 1976, pp.30–34.
4. Tanavoli & Wertime 1976, pp.23–4.
5. Tanavoli & Wertime 1976, pp.24–6. According to Beyhaqi (1993) the practice of attaching an ex-voto (*dakhīl*) to a holy place has always been particularly popular with women, who use a lock or a piece of cord or cloth from their personal effects, often a head scarf. Beyhaqi did not cite Tanavoli and Wertime's work and concentrated on pieces of cloth tied to sacred trees, following Henri Massé and others.
6. Tanavoli & Wertime 1976, pp.26–9.
7. See Rome 1989, for example.
8. Pitt-Rivers 1883, p.19, and pls V, VI; Wulff 1966, p.70. The body of a lock of the same type and the same size as cat.232, for example, formed part of a hoard buried in Suffolk in the late Roman period (Manning 1985, no.O67).
9. Manning 1985, no. D4. Shears of this type can be seen in use in medieval European miniatures such as those in *Les Très Riches Heures* of the Duc de Berry (see Bautier 1971, pl.121, also pl.123).
10. Geneva 1995, pp.247–8.

220–227
Eight 'shrine locks'
Iraq, Iran and India, 17th, 18th and 19th centuries

This type of barbed-spring padlock with a horizontal body has been identified as a 'shrine lock',[1] and its use in tombs and other places holy to Shi'is is documented by inscriptions on several examples. These include cat.222, which was donated to an important Shi'i shrine in Iraq. Other examples are too small for this purpose, however, and the padlocks made for the Ka'bah, the most sacred of buildings for all Muslims, in the 15th, 16th and 17th centuries are not of this type.[2]

Several specimens in the Collection (cat.220, 223, 226 and 227) are of a type attributed to Isfahan. Most of the group have calligraphic and ornamental motifs executed in reserve against a hatched ground.[3] This style was characteristic of the city's metalwork production from the turn of the 17th century,[4] but it was also diffused to other centres, and the decoration of cat.223, for example, resembles 17th-century work from Kashmir and adjacent parts of north-west India.[5] Cat.221 was also produced in India.[6]

The shackle on these padlocks comes in two parts. One part is fixed to the body of the lock at one end and has a long, straight, hollow section parallel with the body. The second is attached to the locking-piece at one end and has a long spike that fits into the hollow section of the first. The locking-piece also bears the barbed-spring mechanism, which fits into the body of the lock and holds the padlock shut.

The body is formed of two chambers. The upper is open at one end, to receive the locking-piece, and at the bottom, to allow the barbs to expand and hold the lock shut. The lower chamber covers the open base of the upper chamber and has a complex opening on one side: only a key of a certain shape can be inserted through it to press up the barbs and release the locking-piece. The 'decorative' bracket beneath the lower chamber provides some security, as the key must fit round it in order to function (see cat.222). Cat.225 and 226 represent a variant which is opened from the front by a simple turning key.

1. Tanavoli & Wertime 1976, pp.106–9, nos 199–217.
2. Sourdel-Thomine 1971, nos 13–21.
3. *Cf.* the ornament on Tanavoli & Wertime 1976, p.107, no.214, and Rome 1989, nos 1, 5 and 7, all 17th- or 18th-century.
4. Melikian-Chirvani 1982, pp.264–74.
5. Melikian-Chirvani 1982, nos 167, 167b.
6. Pitt-Rivers (1883, pl.VI) illustrates 'shrine locks' from India and Egypt.

220
Steel, forged and cast, with engraved decoration, 9.8 × 16 cm
accession no. SCI322

The body is engraved on the two long sides with poetic inscriptions in *nasta'līq* script, reserved against a hatched ground. The lines on the front, 'In the name of God, the Merciful, the Compassionate! There is a key to the door of the treasury of the Wise One', constitute the first couplet of the *Makhzan al-asrār* ('Store of secrets') of Nizami of Ganjah, and thus the first lines of that poet's *Khamsah* ('Five tales'). The lines on the back are from a different source and do not scan correctly. They may be translated as, 'O God! Open Thou a door for me! [My] greatest wish [is] that I do not [have to] look for favours from any other [source]'.

221
Steel, forged and cast, with traces of silver inlay, 9.8 × 14.2 cm
accession no. SCI349

Only the body of this padlock survives. The upper chamber has geometric patterns in silver inlay on the exterior and an opening at one end made to take two barbed springs, side by side. The lower chamber, which is decorated in openwork and with pairs of bosses on the short ends and the base, has a false floor.

On the basis of its form and decoration, this lock may be attributed to India.[1]

1. Compare Rome 1989, no.2.

222
Iron or steel, forged and cast, with engraved and punched decoration, 13 × 26.5 cm, the key, 6 × 19.2 cm
accession no. SCI76

This substantial shrine lock bears a documentary inscription on the two long sides of the lower chamber. On one side the name of the donor is given, 'Al-Hajji 'Ali, son of the late Hasan, made it *waqf*', that is, 'made it inalienable property', and on the other an indication of the recipient institution, an inventory number and the date are supplied, 'Inalienable property of [the shrine of] 'Ali al-Hadi and al-Hasan al-'Askari, [no.]4, *anno* 1215', equivalent to AD 1800–1.

The inscriptions were executed in the *naskh* style of script, rather than the Persian *nasta'līq*, in reserve against a ringmatted ground. This, and the location of the shrines of 'Ali al-Hadi and Hasan al-'Askari at Samarra' in Ottoman Iraq, suggests that the lock was manufactured in Iraq rather than in Isfahan.

223
Steel, forged and cast, with engraved decoration, 7.7 × 14.3 cm
accession no. SCI348

The engraved decoration on the sides and base of the body includes an inscription in *nasta'līq* script, reserved against a hatched ground. On both sides this consists of the invocation, *'āqibat khayr bād* ('May [your] end be good!'), that is, 'May you receive God's grace when you die!'

Screwholes have been pierced through both sides of the upper chamber and through the base of the lower chamber, from which it appears that two additional screw mechanisms were added to make the lock more secure.

This lock may be of Indian origin (see above).

224
Steel, forged, 7.2 × 10.8 cm
accession no. SCI358

This padlock and cat.226 below were opened by a turning key rather than the push key used for the other examples in this group.

225
Steel, forged, 2.7 × 3.9 cm
accession no. SCI359

Two examples similar to this piece, the tiny size of which precludes its use as a shrine lock, were collected in Iran at the turn of the 20th century by Henri d'Allemagne.[1]

1. D'Allemagne 1335, p.376.

225

226
Steel, forged, with engraved decoration, 6 × 7.5 cm
accession no. SCI350

The decoration on this padlock, which was operated by a turning key, is restricted to the front and consists of guilloche bands and a panel containing floral and foliate scrolls, executed in reserve against a hatched ground.

227
Steel, forged, with engraved decoration, 6 × 7.5 cm
accession no. SCI351

227, detail of decoration

The main mechanism of this padlock was similar to that of the other locks in this group, but both parts of the shackle were detachable, and they are now both lost. The second part was released by a turning key, the hole for which is at one end of the lower chamber.

The engraved decoration, which includes a pair of confronted lions, foliate scrolls and guilloche bands, was executed in reserve against hatched grounds.

220 (top), 221

223 (top), 224 (middle), 226 (bottom left), 227 (bottom right)

228

Padlock with a double mechanism

Probably India, 18th or 19th century

Iron or steel, forged and cast, 31 × 35.2 × 8.4 cm, with engraved and cast-in decoration, the engraved decoration partly gilt; the one surviving key, 14 × 4.2 cm, is for the left-hand keyhole
accession no. SC1265

This padlock is almost too large and too heavy (8.25kg) for one person to handle. The loss of one of the two keys required to open it means that the nature of the double mechanism cannot be established with certainty, but the shape of the lock suggests that the detachable locking-piece that forms one side (that facing downwards in the illustration) is attached to one or more barbed springs (compare cat.229 and cat.237).[1]

The locking-piece is set with two lion's heads, and these are matched by a pair on the other side of the body. The other, engraved decoration is confined to the front of the body and consists of ornamental borders and isolated motifs. The latter include three cartouches containing inscriptions enhanced with gold paint.

One cartouche (top right in the illustration) records the name of Khwajah Bashir Ahmad. He was presumably the man who paid for the lock to be made, probably for a shrine or other religious building. The central cartouche has the phrase, *innī a'tamidu 'alayka* ('Verily do I rely upon Thee'), within a medallion surrounded by floral motifs. The text in the third cartouche, *Naskharūna* [*sic*!] *minkum kamā taskharūna minnā* ('We ridicule you just as you ridicule us'), appears to be a paraphrase of words spoken by Noah in surah *Hūd* (XI, verse 38): 'Forthwith he [starts] constructing the Ark. Every time the Chiefs of his People passed by him, they threw ridicule on him. He said: "If ye ridicule us now, we [in our turn] can look down on you with ridicule likewise."'

It should also be noted that both keyhole flaps are engraved with the letter *ṣād*.

1. *Cf.* also Rome 1989, no.30, which is ascribed to India or Tibet in the 18th or 19th century.

229

Padlock with a barbed-spring mechanism

Provenance and date unknown

Iron or steel, forged, 8.1 × 8.4 cm
accession no. SC1360

This is a much smaller and simpler version of cat.228, to which it is linked by its format, including the shaped flange along the base. One side is formed by the detachable locking-piece, to which the bar-like shackle and a single barbed spring are attached. The keyhole is on the other side, opposite the end of the spring.

In an Iranian context items of this type are referred to as cradle locks.[1]

1. Tanavoli & Wertime 1976, p.92, nos 131–3.

230

Padlock with a barbed-spring mechanism

Middle East, date unknown

Copper alloy, with iron or steel springs, now corroded, and engraved decoration, 3.8 × 9.1 cm; the body cast in two pieces and soldered
accession no. SC1100

The horizontal body has been worked as a fish,[1] with an engraved pattern of crossed lines on the front. The spike-shaped shackle is attached at one end to the locking-piece, the rest of which is concealed within the fish's head, while the free end is threaded through a hole in a vertical element near the fish's tail; both the vertical element and the shackle sport a tiny bird-shaped finial. The spring mechanism attached to the locking-piece is contained within the fish's body, and a tiny key was slid along the slit in the front of the body to depress the springs within and release the locking-piece, and with it the shackle.

As in the case of cat.231 and cat.232, the kind of mechanism seen in this piece is of some antiquity, and the combination of a barbed-spring mechanism and a fish-shaped body has been traced back to Roman Egypt, 'though not without hesitation'.[2] However, the bird-shaped finials are of a type current in the Byzantine and Islamic worlds in the Middle Ages (compare cat.250), and they detract rather from the original conceit of a fish caught on a line.

1. For other types of fish-shaped padlocks, see cat.266 below, and especially Tanavoli & Wertime 1976, p.77, no.100; Rome 1989, no.178.
2. Pitt-Rivers 1883, p.22, and pl.IX, figs 100C, 101C; see also figs 102C–104C for a modern (*i.e.* 19th-century) Indian example.

229

230

231, 232 (top view)

231, 232

Two padlocks with a barbed-spring mechanism

India or Nepal, 19th or 20th century

Locks of this type, with a body reinforced with hoops and a shackle in the form of a long spike, have been known in Iran since at least the Sasanian period,[1] but later Iranian specimens, such as those collected by Parviz Tanavoli in Azerbaijan,[2] have a more integrated design, in which the locking-piece is much reduced. As a result they lack the panache of these two examples from the Indian subcontinent, where the locking-piece retains a horizontal element that is as long, or almost as long, as the body. Even in India, though, there was a tendency to reduce the locking-piece to a simple vertical element with a hole for the spike of the shackle at the top and the springs attached at a right angle at the base.[3]

1. Tanavoli & Wertime 1976, pp.52–3; p.55, no.3; pl.I, no. 4; p.56, no.6. Similar padlocks were in use in Roman Britain: see Pitt-Rivers 1883, pl.V, figs 21C–25C; Manning 1985, nos 067–070.
2. Tanavoli & Wertime 1976, p.93, nos 134, 135.
3. See Pitt-Rivers 1883, pl.VI, figs 44C–46C, from 'The Gate of Moultan'; Rome 1989, nos 31, 33–35.

231

Iron or steel sheet, with traces of a copper alloy, 10 × 28.5 cm; iron or steel key, 13.8 cm long
accession no. SCI318

This lock is a larger version of one produced in Nepal in the 19th or 20th century.[1] The light, cylindrical body of the lock, reinforced by three hoops, has two holes for the springs at one end; a long spike that acts as a shackle is fixed to the other end; and the keyhole has been cut into the cylinder, in front of the shackle joint.

The locking-piece is more or less triangular and is composed of several layers of metal sheet, which are held together in part by the perpendicular handle. At the back, at the broad end, there is a short, horizontal element with a hole in which the spike of the shackle engages. The narrow end is furnished with two barbed springs.

The key has a cypress-shaped handle with a curl at the end and a U-shaped vertical bit.

1. Rome 1989, no.37; *cf.* also nos 38, 39.

232

Iron or steel sheet, with traces of a copper alloy, 8.2 × 33.5 cm, with engraved decoration; iron or steel key, 22 cm long
accession no. SCI352

This lock may be attributed to India on the basis of its similarity, in terms of its form, with a splendid Bidri-ware example in an Italian collection.[1]

The body is square in section and is reinforced with four hoops with simple engraved decoration, as is the outer face of the locking piece. One end of the body is formed by the base of the long, spike-shaped shackle, and the joint is reinforced by a collar-like plate. The plate at the other end is pierced to take the three springs on the locking-piece.

The locking-piece is roughly oval. It bends backwards at one end, where there is a hole to engage the shackle. The three springs at the other end all had two barbs, although one has broken off.

The key is very similar to that of cat.231.

1. Rome 1989, no.32.

233

Part of a padlock with a barbed-spring mechanism

Probably Herat, third quarter of the 15th century

Copper alloy, one half of a body cast in two halves and riveted, decorated with silver inlay, 3.2 × 8.2 cm
accession no. SCI278

This fragment is from a small padlock much like cat.234 in form, although it may have been opened by a key pushed in from one end.

The inlaid decoration may be compared with that of wares produced in Herat in the mid-15th century, under the patronage of the Timurids. One example is a brass jug signed by Habiballah ibn ʿAli Baharjani in AH 861 (AD 1456–7),[1] and a pen case of AH 865 (AD 1460–61) with ornament in this style bears the same valedictory inscription, a couplet from the *Būstān* of Saʿdi, 'May the world be as you desire, and the heavens be your friend! May the Creator be your protector!'[2] The quotation also appears on a Timurid jug of inlaid brass in the Khalili Collection (MTW305).

1. Lentz & Lowry 1989, no.109, illustrated on p.206. *Cf.* also Melikian-Chirvani 1982, no.109; Lentz & Lowry 1989, no.110.
2. Melikian-Chirvani 1982, pp.236–8, figs 61A–B.

234

Part of a padlock with a barbed-spring mechanism

Iran or India, date unknown

Copper alloy, cast in two halves and soldered, 3.2 × 8.2 cm
accession no. SCI354

The body, which is all that survives, consists of a long box, with an opening at one end to receive the spring mechanism and a slit for the key on the front. There is a decorative bracket on the underside, while the rod-like shackle, now broken, is attached to a square element with a 'dome' and 'finial'.

This motif, which also appears in the Timurid lock cat.233, is found on a large proportion of the oversized barbed-spring padlocks made for the Kaʿbah in Mecca in the Mamluk and Ottoman periods, including those sent to Mecca in the names of Sultan Faraj in 1401–2 and of Sultan Süleyman I in 1565–6.[1]

1. Sourdel-Thomine 1971, nos 13, 16.

233

234

235–237

Three padlocks

Morocco, 19th or 20th century

Despite their different shapes and mechanisms, these three locks all appear to be of Moroccan origin. All three are made of iron and are faced in part with brass sheets, which have engraved or repoussé floral ornament, different in each case. The most distinctive is that on cat.236, which may be compared with other Moroccan wares of the period, including a number of bracelets from Essaouira and Marrakesh dated to the late 19th or early 20th century.[1]

1. Rouach 1989, especially no.148.

235

Iron, with brass facings with engraved decoration, 8.5 × 13.5 cm; the iron key, 18.8 × 2.5 cm, has two brass appliqués with repoussé decoration
accession no. SC1319

This lock has a barbed-spring mechanism, with a spring at each end of the C-shaped locking-piece.[1] The box-like body has been reinforced with three iron hoops, and the spaces between the hoops filled with loose brass collars engraved with a simple design of flowers with four petals.

1. *Cf.* Pitt-Rivers 1883, pl.VII, figs 68C–70C, an Indian example.

236

Iron, faced with a brass sheet with repoussé decoration, 11 × 11.5 cm, with an iron key, 11.5 × 3.4 cm
accession no. SC1320

The helical spring of this padlock is contained within the pipe-shaped body. The other part of the mechanism is a free-floating disc, held vertical by the spring. On the side of the plate away from the keyhole there is a horizontal catch, which passes through a hole in the free end of the shackle. On the side of the plate facing the keyhole there is a horizontal screw. The key has a hollow bit with an interior thread, which engages with this screw, and, as the key is turned, it pulls the plate, and with it the catch, away from the free end of the shackle, which is released.

The decoration is confined to the brass facing: on each side there is a band of four rinceaux, each surrounding a single flower with four petals.

237

Iron, faced with a brass sheet with engraved decoration, 7.8 × 7.8 cm, with an iron key, 6.7 × 2.5 cm
accession no. SC1321

This padlock, like cat.235, has a barbed-spring mechanism, but the form is quite different. The horizontal, bar-shaped shackle and the single barbed spring are both attached to a vertical locking-piece. To close the lock, this locking-piece is pushed into the right-hand side of the body; the spring lodges in the main body of the lock, while the shackle passes through the U-shaped upper section. To open it, the key is turned clockwise.

The engraved decoration consists of a central palmette (reduced to a frame round the keyhole on the front of the lock) and a border of irregular 'petals'.

235

236 (top), 237

238, 239

Two padlocks with a barbed-spring mechanism

Iran, 20th century

Copper-alloy body cast in two halves and soldered, 2.9 × 4.3 cm, with engraved texturing; copper-alloy shackle with iron or steel springs and a copper-plated tip
accession no. SC1363

Copper-alloy body cast in two halves and riveted, 3.4 × 4.4 cm, with punched and engraved decoration; copper-alloy shackle with iron or steel springs; both body and shackle are chrome-plated
accession no. SC1362

These two items in the shape of a lion appear to be 20th-century versions of a type of small padlock current in Iran since at least the 18th century.[1] The group to which they belong is characterized by a double collar and the absence of a mane.

1. *Cf.* Rome 1989, nos 154–60.

240–245

Six padlocks with a barbed-spring mechanism

Iran, 19th and 20th centuries

Brass bodies cast in two halves and riveted, with engraved decoration, all approximately 3.5 × 4.5 cm; one retains its copper-alloy shackle with iron or steel springs
accession nos SC1381–SC1383, SC197, SC1384, SC1385

These padlocks are in the form of a tiny lion with a collar and mane and appear to have been produced in the same manner, and presumably by the same artisans, as cat.255–9.[1]

1. *Cf.* Pitt-Rivers 1883, pl.IX, figs 107C–109C, 'belonging to Mr. CHUBB'; Tanavoli & Wertime 1976, p.70, no.58; Wertime 1977, p.159, A; Rome 1989, no.162.

238, 239 (top); 240, 241, 242, 243, 244, 245

246, 247

Two padlocks with a barbed-spring mechanism

India, 19th or 20th century

Brass, cast and sheet, 6.5 × 9.3 cm and 8.5 × 10.1 cm, with springs of iron or steel sheet; the keys, both 14.9 cm long, are of brass sheet, with engraved decoration
accession nos SC177, SC1317

The lion-shaped bodies of these two locks have a keyhole in the breast and a single hole for a pair of barbed springs at the rear. The springs are attached to one end of the sinuous shackle, which forms the tail of the beast. The other end of the shackle is engaged in a hole in the back of the lion's head. The keys have a cypress-shaped handle, a straight, flat shank and a perpendicular, H-shaped bit.

246 (top), 247

248

Padlock with a barbed-spring mechanism

Anatolia or Iran,
perhaps 11th–13th centuries

Copper alloy, cast in two halves and soldered, 4.2 × 4.5 cm
accession no. SC1353

This delicate, horse-shaped padlock may be compared with one in the Tanavoli Collection, which has been dated to the 11th–13th centuries.[1] In this case the shackle has broken off, but the end with the springs attached is still in place, at the rear end of the horse. There is a hole for the other end of the shackle in the back of the horse's head, and a slit for a tiny slide key in one side of the body.

248

1. Tanavoli & Wertime 1976, p.60, no.19. See also Kocabaş 1965, pl.xc, fig.12, pl.xci, fig.15 (reproduced as Erginsoy 1978, pp.347–8, fig.183); Bodur 1987, p.93.

249, 250

Parts of two padlocks with a barbed-spring mechanism

Anatolia or Iran,
perhaps 11th–13th century

Copper alloy, cast, 4.3 × 5.3 cm and 4.9 × 5.5 cm
accession nos SC1103, SC1104

These two fragments each consist of half of the body of a lock in the form of an unidentified quadruped. Although the alloys and decorative treatments employed are different, the size and shape of the two locks were very similar, and they may be compared with a lock in the Tanavoli Collection that has been dated to the 11th–13th centuries,[1] and with examples in the Sadberk Hanım Museum, Istanbul, attributed to the 13th century.[2]

249

250

lock and is decorated with a pattern of drilled dots. There are holes for two springs in the rear end of the animal, a keyhole in the breast, and a hole to engage the free end of the shackle in the back of the head. Cat.250 is the right-hand section of a lock and has the larger half of the keyhole. Its decoration is distinguished by the bird-shaped finial on the animal's head (compare cat.230).

1. Tanavoli & Wertime 1976, p.83, no.111.
2. Bodur 1987, p.93; see also Kocabaş 1965, pl.xcii, fig.16 (reproduced as Erginsoy 1978, pp.347–8, fig.183).

251

Part of a padlock with a barbed-spring mechanism

Perhaps Khurasan, 11th–13th century

Copper alloy, cast, 5.4 × 5.7 cm
accession no. SC1355

This item constituted the left-hand section of the body of a small, horse-shaped padlock. Its relief decoration, now much corroded, may be compared with that on three other zoomorphic padlocks dated to the 11th–13th centuries,[1] as well as an example in the Victoria and Albert Museum, attributed to Khurasan in the 11th or 12th century.[2]

1. Tanavoli & Wertime 1976, p.59 and pl.II, nos 12–13; Rome 1989, no.150. See also Tanavoli & Wertime 1976, p.65, no.43; pl.II, no.101; p.81, no.109.
2. Melikian-Chirvani 1982, no.18. See also Bodur 1987, p.93.

251

252, 253

Two padlocks with a barbed-spring mechanism

Iran, 17th–19th centuries

Steel, cast and forged, with engraved and copper-alloy inlaid decoration, 5.9 × 5.4 cm and 5.9 × 6.1 cm
accession nos SC179, SC181

The two padlocks are in the form of two different animals, but in other respects, not least their inlaid decoration of dots and dashes, they are very similar.

Cat.252 is in the form of a hare with its head turned backwards so that its 'mouth' may receive one end of the shackle. In this case the shackle has

252

253

been inserted upside down in error, so that it runs beneath the hare's feet. The piece may be compared with a similarly shaped lock in the Tanavoli Collection, which has been dated to the 17th or 18th century.[1] However, two other examples have been dated to the 19th century.[2]

Cat.253 is in the form of an unidentified quadruped, perhaps a lion, which faces foreward and therefore has the hole to engage one end of the shackle in the back of its head.

1. Tanavoli & Wertime 1976, p.80, no.106, where the animal is identified as a goat.
2. Rome 1989, nos 169, 170.

254

Part of a padlock with a barbed-spring mechanism

Iran, 19th or 20th century

Copper alloy, cast in two halves, with engraved decoration, 4 × 3.9 cm
accession no. SC1357

The bird-shaped body, the only part of the lock that survives, has a keyhole on one side and a hole for a pin on the other, which shows that the barbed-spring mechanism was operated by a turning key, as in cat.261 and 262. There are holes in the tail and the back of the head for the two ends of the shackle.

A similar piece has been dated to the 14th or 15th century,[1] but cat.254 is clearly of much more recent manufacture.[2]

1. Tanavoli & Wertime 1976, p.73, no.70.
2. *Cf.* Rome 1989, no.183, which has retained its shackle.

254

255–259

Five padlocks with a barbed-spring mechanism
Iran, 19th and 20th centuries

Brass bodies cast in two halves and riveted, with engraved decoration, and brass or steel shackles with iron or steel springs, all approximately 4.5 × 4.5 cm; cat.257 is enhanced with blue glass beads resembling turquoises; cat.255–7 have copper-alloy keys, 4.9 cm long
accession nos SC1387, SC1386, SC182, SC183, SC185

These five items represent the latest and most realistic form of horse-shaped padlock: the type was still current when Hans E. Wulff was carrying out his researches, *circa* 1937–41.[1] Cat.257 is particularly elaborate, as its eyes are set with 'turquoises', and its flanks are engraved with a depiction of a young woman on one side and of a young prince on the other.

1. Wulff 1966, pp.70–71, and fig.106. See also Tanavoli & Wertime 1976, pp.59, 63, no.38; Rome 1989, nos 151, 152.

260

Part of a padlock with a barbed-spring mechanism
Iran, 19th or 20th century

Brass body cast in two halves and riveted, with punched decoration, 4.4 × 3.9 cm
accession no. SC1361

The body of this lock, which is all that survives, is in the shape of a goat, with its head turned back so that the end of the shackle engaged with its 'mouth', and it is very similar in structure to cat.238–45 and cat.255–9.

Two almost identical goat-shaped padlocks, at least one complete with shackle and key, were collected by Parviz Tanavoli in Qazvin and Zanjan,[1] while another is in a private collection in Italy.[2]

1. Tanavoli & Wertime 1976, pp.78, 80, nos 107–8; no.108 is dated to the 17th or 18th century.
2. Rome 1989, no.171, which is dated to the 20th century.

255, 256, 257, 258, 259, 260

261

Part of a padlock with a barbed-spring mechanism

Iran, perhaps 14th or 15th century

Copper alloy, cast in two halves, with drilled decoration, 3.3 × 4.3 cm
accession no. SC193

The body of the lock, the only part to survive, is in the form of a quadruped with an open maw and bears a scattering of dot and ring motifs.[1] The form may have originated as a roaring lion,[2]

261

but by the Qajar period a ferocious beast of this type had taken on an independent existence.[3]

The keyhole in the left side indicates that the springs were released by pressure from a turning key, rather than from a key pushed in from the front, as in most other animal-shaped locks. Opposite the keyhole, in the right side, there is a round hole which must once have held a pin that engaged the bit of the turning key. There are also holes in the rear end of the animal and in the back of its head, for the two ends of the shackle.

A horse-shaped padlock of the same overall type has been dated to the 14th or 15th century.[4]

1. The form recurs in Tanavoli & Wertime 1976, p.84, no.115, but this example is cruder and lacks the surface decoration.
2. *Cf.* Tanavoli & Wertime 1976, p.69, no.51; Rome 1989, no.166.
3. Surieu 1967, p.157.
4. Tanavoli & Wertime 1976, p.60, no.28.

262

Part of a padlock with a barbed-spring mechanism

Iran, perhaps 14th or 15th century

Copper alloy, cast in two halves, 3.5 × 4.6 cm
accession no. SC188

This padlock is very similar to cat.261, but it lacks the drilled decoration and is in the form of a caprid. The shackle has broken, but the locking mechanism is still lodged inside the body

262

263–265

Three padlocks with a barbed-spring mechanism

Iran, 18th and 19th centuries

Iron or steel, cast and forged, all originally approximately 5.5 × 5.5 cm; copper-alloy inlay survives in two cases
accession nos SC186, SC1388, SC187

The popularity of small horse-shaped padlocks in Qajar and post-Qajar Iran is demonstrated by this group and by cat.255–9 above.[1]

1. *Cf.* Tanavoli & Wertime 1976, pp.59, 62, no.34.

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Lock

India, AH 1242 (AD 1826–7)

Iron or steel and copper alloy, forged and sheet, riveted and soldered, 33 × 11.5 × 2.3 cm, with inlaid silver decoration and ornamental plaques of a copper alloy; with two couplings, 23 cm and 21 cm long
makers Usta Yar Muhammad and Usta ?Makhfi
accession no. SC1281

This fish-shaped lock has survived with the two couplings still attached. The body of the lock is of box construction and consists of two iron or steel plates separated by a band of the same metal faced with brass sheet. It is held together by eight rivets with dome-shaped heads and was fixed to the object it locked by two bolts that ran through large holes near the fish's head and tail. The front is decorated with patterns inlaid in silver, and a cartouche towards the tail contains the signature and date, also inlaid in silver: *1242 'amal-i Ustā[d] Yār Muḥammad* ('1242. The work of Master Yar Muhammad').

The principal keyholes are covered by a plate (4 × 14 cm), the end of which has been broken off, presumably when someone was trying to prise the lock open. In the process most of the ornamental plaque that covered the plate was also broken off. Below the keyhole plate there is a small flap faced by a second ornamental plaque. This probably covers a secondary keyhole but is now corroded shut: the key inserted here would have released the plate covering the main keyholes.

The two ornamental plaques have networks of foliate scrolls worked in deep relief. They are finer work than the rest of the lock and are in an archaic style, and they may well have been reused.

The two couplings retain the split pins by which they were attached to a wooden object of some size. Both are crudely engraved, one with the signature, *'amal-i Ustā[d] ?Makhfī* ('The work of Master ?Makhfi'), and the other with the legend, *mālikuhū Mullā Mīrzā-yi Bukhārī* ('Its owner is Mulla Mirza Bukhari'), the letters *alif* and *lām* and the numerals 1 and 2.

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264

265

The bent-spring mechanism

In this type of lock, the working parts, a spring and a hook, are contained within the body. In cat.271, for example, the base of the hook is attached to the body by a pin, while the other end engages with a recess in one end of the shackle. This cannot be withdrawn so long as the hook is held in place by the spring, which sits between the hook and the body. The key that went with cat.271 is now lost, but the brass key that was acquired with cat.269 has a hollow cylindrical bit with a simple projection on one side. When inserted into the keyhole and turned clockwise, it counteracts the force of the spring, pushing the hook away from the end of the shackle, which is released.[1]

1. See also Tanavoli & Wertime 1976, pp.32–6.

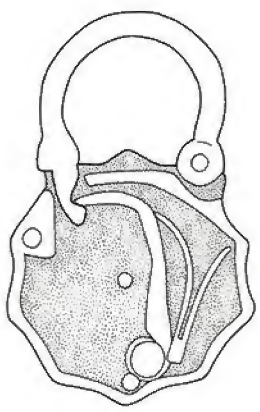

Figure 17 271, section showing bent-spring mechanism

267

Padlock with a bent-spring mechanism

Iran, 18th or 19th century

Brass body, cast in two halves, riveted and engraved, the mechanism and pins probably steel, 4.7 × 4.4 cm
accession no. SC178

This piece is clearly related to the horse-shaped padlocks with a barbed-spring mechanism, cat.255–9.[1]

1. See also Rome 1989, no.153, which retains its iron shackle.

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268–271

Four padlocks with a bent-spring mechanism

Iran, 18th or 19th century

Copper alloy, body and shackle cast in three sections and riveted, all approximately 6 × 3.5 cm, variously decorated with engraved, punched and drilled details and glass beads; the mechanism is of steel sheet; cat.269 retains its brass key, 4 × 1.8 cm
accession nos SC1389, SC1323, SC1390, SC196

The front of the body was worked as the face of a lion, and in all but one case (cat.269) the eyes and a mole on the forehead took the form of tiny glass beads, which survive in cat.268 and 270.[1]

1. *Cf.* Tanavoli & Wertime 1976, pp.65, 71, nos 65, 66; Rome 1989, no.185.

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269

270

271

272

Padlock with a bent-spring mechanism

Iran, 17th century

Iron or steel sheet, 13 × 17 cm;
the iron or steel key, 7 × 4 cm
accession no. SC1167

The body of the padlock is in the form of a charming stylized quadruped. It is of box construction and was fabricated from metal sheets which are held together by pins.

273

Padlock with a double mechanism

Iran, 17th–19th centuries

Steel sheet, secured by pins, with engraved decoration, 5.7 × 7 cm
accession no. SC180

According to Tanavoli and Wertime, this type of bird-shaped padlock is called a *bulbul* ('nightingale') by the people of Shīrāz.[1] The main mechanism is of the bent-spring type, and the keyhole for it can be seen in the centre of the body of the bird. This would originally have been covered by a wing-shaped flap, with a hinge attached to the body through the hole to the right of the keyhole, and a hook that engaged with the hole to the left. The hook was held in place by a helical-spring mechanism which was released by turning a key in a hole in the tail.[2]

1. Tanavoli & Wertime 1976, p.72.
2. For complete examples, see Tanavoli & Wertime 1976, pl.IV, no.75; Rome 1989, no.181. See also Rome 1989, no.182.

274

Padlock with a bent-spring mechanism

Iran, 17th–19th centuries

Steel sheet and copper alloy, soldered and riveted, with engraved decoration, 4.6 × 5.9 cm
accession no. SC191

This padlock is in the form of a goat, and the production of the type has been located in Isfahan and Shiraz.[1] In its general characteristics the piece is similar to cat.273.

1. Tanavoli & Wertime 1976, pp.78–9, nos 103–5.

275–301

Twenty-seven padlocks with a bent-spring mechanism

Iran, 17th–19th centuries

Silver, steel and brass, cast and sheet, measuring between 2.5 × 1.5 cm (cat.275) and 19.2 × 8.5 cm (cat.290)
accession nos SC1394, SC195, SC1393, SC1391, SC1392, SC1395–SC1402, SC189, SC1403–415

This group displays the great variety of forms achieved in the small bent-spring padlocks produced in Iran in the late Safavid to Qajar periods. The shape of cat.280 and cat.281 has been interpreted as a stylized fish,[1] and cat.278 has two bird's-head finials, which are attached to a form, also seen in cat.279, described as a dervish's bowl.[2] Cat.277 and cat.282–6 have the outline of a stylized palmette, while cat.291–3 follow the asymmetrical lines of the *butah* motif, and cat.276, cat.287–90 and cat.295 are heart-shaped.[3] The holes in the front and back of cat.276 may once have held small imitation turquoises or other glass decoration,[4] while cat.287 and cat.289 have talismanic inscriptions (see p.356 above).[5]

Other shapes have been likened to pocket watches (cat.294), handbags (cat.298), and ball-shaped steel weights (cat.299).[6] These last have been attributed to the province of Fars, while the heavier heart-shaped locks with keyhole covers have been ascribed to Isfahan.[7]

1. Tanavoli & Wertime 1976, p.77, no.98; Rome 1989, nos 174–7.
2. *Cf.* Tanavoli & Wertime 1976, p.74, no.87; p.112, no.228 (see also Rome 1989, no.112).
3. *Cf.* Tanavoli & Wertime 1976, p.110, no.218 (also Rome 1989, no.114); p.123, no.293, and p.133, no.351; pp.96–99, nos 140–61 (also Wertime 1977, p.159, G, H).
4. *Cf.* Tanavoli & Wertime 1976, p.99, no.157.
5. *Cf.* Tanavoli & Wertime 1976, pp.123–6, nos 292–318; Rome 1989, pp.223–38, especially no.191.
6. Tanavoli & Wertime 1976, pp.131–2, nos 349, 350; p.134, nos 368, 369; p.122, nos 285–91 (see also Rome 1989, no.131).
7. Tanavoli & Wertime 1976, p.96.


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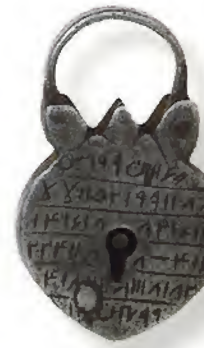

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302–306

Five padlocks with a bent-spring mechanism

India, 19th and 20th centuries

Brass, cast and sheet, with engraved and stamped decoration, measuring between 6.7 × 4 cm (cat.302) and 8.9 × 5.8 cm (cat.306); the mechanisms may be of steel
accession nos SC1416, SC1370, SC1368, SC1371, SC1369

These five locks were produced in different parts of India under British rule and in imitation of British or other European-produced locks. Four bear legends in English giving the names of their makers, Imtiaz, Karachi (cat.302), Habib & Co. of Aligarh (cat.304), Ismail Maker (cat.306), and perhaps the Indian Key Company (cat.303; the word 'Key' has been reversed), while cat.305 is inscribed with the legend, *shahr-i Jālandhar* ('city of Jalandhar'),[1] the number '4', and the name Ghulam Muhyi'l-Din ?Banna-yi Dana.

1. See cat.308 below.

307, 308

Two padlocks with a helical-spring mechanism

Jalandhar, 19th century

Brass sheet, engraved, 5.1 × 2.8 cm (cat.307), 5.1 × 4.2 cm (cat.308); cat.307 retains its steel key, 3.6 × 1.7 cm
maker Muhammadshah (cat.307)
accession nos SC1380, SC1379

These two padlocks have different shapes and decoration, but they both appear to have been produced in the town of Jalandhar in the northern Punjab. Cat.308 is engraved with the name of the town, as are cat.305 above and no less than seven brass padlocks in an Italian collection, all of which were acquired in Iran or Afghanistan.[1] One of the seven is very similar in form and decoration to cat.307, which may therefore be attributed to Jalandhar.[2] This piece is elegantly inscribed at the end opposite the keyhole with the name of the maker, Muhammadshah.

1. Rome 1989, nos 61, 63, 66, 69–72.
2. Rome 1989, no.72.

309

Padlock with a helical-spring mechanism

Iran, Afghanistan or India, 19th century

Brass sheet, engraved, 5.8 × 3.8 cm; the steel key, 4.9 × 2.5 cm
accession no. SC1378

This padlock has a very similar shape to the Fars type represented by the miniature pieces cat.319–21 below, but it also resembles the Indian brass locks cat.307 and cat.308. A very similar, but smaller, 19th-century piece was collected in Afghanistan.[1]

1. Rome 1989, no.65.

310–312

Three padlocks with a helical-spring mechanism

Iran, 18th or 19th century

Brass, cast and sheet, and forged steel, 7.2 × 3 cm, 8.5 × 3.8 cm, 6.5 × 2.9 cm (closed); cat.312 retains its steel screw key, 4.2 × 1.6 cm
accession nos SC1373, SC1372, SC1366

These three puzzle locks have a vertical helical-spring mechanism within the cylindrical body, which is normally hidden by the brass casing with a cylindrical upper section and a dome-shaped base. The rounded shackle is attached at one end to the bracket mounted on top of the body.

As in cat.331, the lock presents the user with the puzzle of finding the keyhole. This is sited below the hinged end of the shackle, but it can only be seen when the casing has been partly unscrewed.[1]

1. Other examples of the type are Rome 1989, nos 144, 145. *Cf.* also Tanavoli & Wertime 1976, pp.118–19.

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The helical-spring mechanism

As we have seen in the case of cat.236 and cat.307–12 above, this type of mechanism is based on a helical spring and a plate with a catch that engages with a hole or indentation in the free end of the shackle. The tension of the spring keeps the plate in place, and the lock shut. The force of the spring is counteracted by the turning of the key. This pulls the plate towards the keyhole and away from the shackle, which is released. The key may have a threaded bit, in which case it engages with a threaded hole in the plate, or a hollow bit with an interior thread that engages with a screw projecting from the plate.[1]

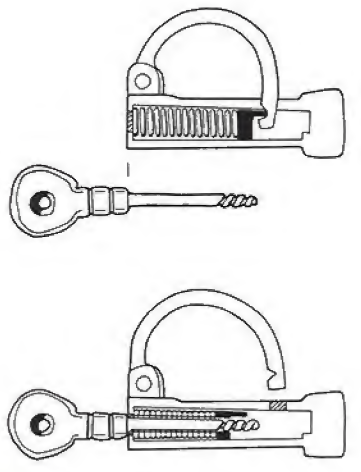

Figure 18 313, section showing operation of helical-spring mechanism

1. See Tanavoli & Wertime 1976, pp.36–40.

313–315

Three padlocks with a helical-spring mechanism

Western Iran, 19th or 20th century

Cast brass bodies, with drilled decoration, forged steel or copper shackles and steel mechanisms, 3.2 × 5 cm, 4.5 × 7.1 cm, 3.6 × 5.1 cm; cat.313, 315 have steel keys, 5.8 × 1.5 cm, 5.4 × 1.1 cm
accession nos SCI340, SCI331, SCI335

These three items show great consistency in their construction and decoration with other published examples, suggesting that they were all produced by a restricted circle of craftsmen. A group of similar pieces in the Tanavoli Collection has been attributed to western Iran, and four of these were reportedly fabricated from the brass cases of spent bullets.[1]

In each case the brass body has a square opening at one end that has been filled with a small steel plate set with the keyhole. On the top of the body, above the keyhole, there is a bracket to which one end of the shackle is attached by a hinge and, at the far end, a hole into which the other end of the shackle is inserted. The method by which the shackle was secured can be observed in the case of cat.313, because of damage to the side of the body (see fig.18).

All pieces of this type are decorated with dot-and-ring patterns that recall the designs, presumed to be of magic significance, on items such as cat.107 and cat.109.[2] All examples also have curiously shaped projections at the opposite end to the keyhole.

1. Tanavoli & Wertime 1976, pp.142–3, nos 411–25; Wertime 1977, p.158, fig. on p.159, C, D; Rome 1989, nos 54–60. Rome 1989, no.53, appears to be an earlier version.
2. See also Tanavoli & Wertime 1976, p.143.

316–325

Ten padlocks with a helical-spring mechanism

Iran, 18th, 19th and 20th centuries

Steel and brass, cast and sheet, measuring between 1.5 × 1.1 cm (cat.321) and 7 × 15.9 cm (cat.316)
accession nos SCI423–SCI425, SCI377, SCI174, SCI108, SCI417–SCI420

This group of locks presents other variations on the helical-spring padlock with a horizontal mechanism. Such locks are often pipe-shaped, but the pipe can be square (cat.323, 325) or octagonal (cat.316), as well as circular (cat.236, 317), in section.[1] Others are barrel-shaped; one type (cat.322) has pronounced ribbing,[2] while another (cat.319–21) has a segmented body – the latter is attributed to the province of Fars.[3] A minority have shapes similar to those of barbed-spring and bent-spring padlocks, as in the case of the lion-shaped lock, cat.318, and of the 'handbag' lock, cat.324.

Locks of this type were often produced in an impressive range of sizes, from very large to very small. Indeed, the miniature type of Fars padlock represented by cat.319–21 has been identified with the form of lock so small that it would fit into the shell of a pistachio nut mentioned by the Safavid prince Sam Mirza in the 16th century.[4]

1. Tanavoli & Wertime 1976, p.129, no.321; pp.130–31, no.331; pp.140–41, nos 402–10; Rome 1989, nos 45–52.
2. Tanvoli & Wertime 1976, pp.127–8, nos 313–19; Rome 1989, nos 78, 79.
3. Tanvoli & Wertime 1976, pp.104–5, nos 175–90; Rome 1989, nos 80–82.
4. Tanavoli & Wertime 1976, p.104.

326–329

Four padlocks with a helical-spring mechanism

Chal Shutur, 19th or 20th century

Forged steel, 6.4 × 6.5 cm, 4.6 × 4.4 cm, 3.8 × 2.5 cm, 4.1 × 2.8 cm; cat.327–9 have a steel key, 4.4 × 1.8 cm, 2.9 × 1.2 cm, 2.2 × 0.8 cm
maker Jalal (cat.328)
accession nos SCI421, SCI422, SCI347, SCI99

Parviz Tanavoli and John Wertime located the production of this type of padlock in the village of Chal Shutur, near Shahr-i Kurd in the province of Chahar Mahal va Bakhtiyari.[1] This was one of the last places in Iran where locks were made using traditional methods: the body was forged, and the shackle holes were then made using a bow drill. The details were filed, and the lock was polished on a lathe.

The type is characterized by the way in which the connection between the horseshoe-shaped shackle and the pipe-shaped body is disguised. The central section of the body is raised, so that it appears that this part of the body is enclosed in a collar – an impression heightened by the surface treatment of the raised 'collar', which is faceted or grooved. A pair of symmetrical brackets that rise from the collar hold the two ends of the shackle: one end is hinged to the bracket, the other is longer and is inserted into a hole in the body of the lock. In many cases there is also a decorative bracket beneath the collar.

The smallest, and most elegant, of the examples in the Khalili Collection, cat.328, which measures no more than 3.9 × 2.5 cm without its key, has been stamped twice on one side of the shackle with a finely engraved, pointed-oval maker's seal, 0.6 cm long, bearing the phrase, *'amal-i Jalāl* ('The work of Jalal') and minute floral motifs.

1. Tanavoli & Wertime 1976, pp.138–9, nos 388–401. See also Wertime 1977, pp.156–7, fig. on p.159, J, K; Rome 1989, nos 93–9.

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Key

Iran, 19th century

Steel, 6.5 × 3.5 cm
accession no. SC194

This key probably operated an escutcheon lock with complex wards. The shaft is hollow, and a hole has been drilled in the top.

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331

Puzzle padlock with a notched-shackle mechanism

Iran, 19th century

Steel, cast and engraved, 3.6 × 7.4 cm, with a collar of brass
accession no. SC1365

This puzzle lock is disguised as a key very similar in form to cat.330.[1] The keyhole is concealed by the brass collar beneath the handle, and the collar can only be lowered when a hidden catch has been released.

The shackle is the two-lobed handle, while the body of the padlock is the shaft. One lobe of the shackle is fixed, while the other is movable and has a notch at the free end, which is inserted into the body.

The catch that keeps the brass collar in place is attached to a bar that passes through the shaft and ends in a retractable disc. The catch is released by pulling this disc out. The collar can then be screwed down to reveal the keyhole. The sole function of the false wards is to prevent the collar from being screwed off completely.

The mechanism is of the notched-shackle type in which a turning key with a simple bit is used to push the notch at the end of the shackle out of the body.[2]

1. *Cf.* Rome 1989, pp.183, 186, no.148.
2. See Tanavoli & Wertime 1976, p.40.

332

Padlock with a shackle-spring mechanism

Probably Isfahan, 19th or 20th century

Steel sheet, 2.9 × 3.4 cm
maker Aqa Ustad Isfahani
accession no. SC1427

In this small, ring-shaped padlock, which was signed by its maker as, 'The work of Aqa Ustad Isfahani', the shackle (left) and the body (right) are almost symmetrical. The shackle is hinged at the top, while the broader base section is hollow and is set with a tiny projecting hook, which engages with a notch in the body. A miniature key was inserted in the keyhole in the body and turned clockwise so that the bit pushed the hook off the notch and released the shackle.

The shape of a similar padlock, but with the base section modelled in a slightly different manner, has been interpreted as a stylized version of the dervish's bowl motif (compare cat.279).[1]

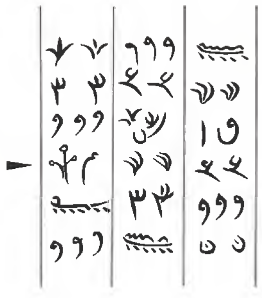
1. Tanavoli & Wertime 1976, pp.112–13, no.239. For a similar lock collected in Iran at the turn of the 20th century by Henri-René d'Allemagne, see d'Allemagne 1335, p.376.

332

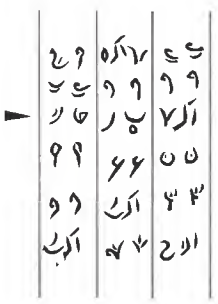
Combination locks

Combination locks were made in Iran by the 11th century at the latest (see cat.344 below), and by the 15th century combination padlocks were being produced.[1] The earliest type have brass drums disposed along a horizontal bar (compare cat.333 and cat.334), and other arrangements include a type with a vertical row of drums, as in cat.337 and cat.338.[2]

1. Fehérvári 1976, pl.50, no.149, which is dated AH 889 (AD 1484). *Cf.* Tanavoli & Wertime 1976, pp.42–3, 116, and pl.VI, no.252; Wertime 1977, p.157, E; Rome 1989, pp.167–8, no.133.
2. On combination locks, see also Wulff 1966, p.72, and fig.109.



333, combination



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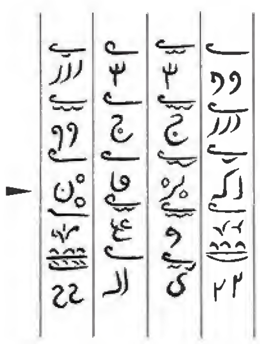
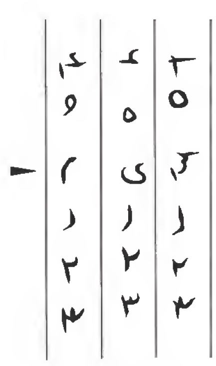
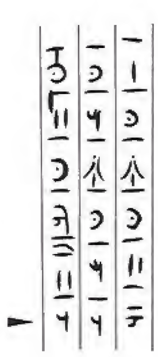


335, combination



336, combination



337, combination

333, 334
Two combination padlocks
Iran, 19th century

Steel and brass, forged and sheet, engraved, 5.7 × 5.1 cm and 5.1 × 4.4 cm
accession nos SC1324, SC1325

Both padlocks have a horizontal mechanism and an integral shackle. They are roughly square in shape.[1] The shaped steel side-pieces are linked at the top by a solid steel bar. This is fixed to the left-hand side-piece and is equipped with a short pin at the end, which fits into a hole in the right-hand side-piece.

The three hollow brass drums arranged in a row at the bottom are each engraved with a different series of numbers and enigmatic symbols. They enclose two other parts: the right-hand side-piece has a key-like steel shaft with a notched flange, while the left-hand side-piece has a hollow steel shaft, with a slit along the front to receive the flange on the 'key'.

The drums each have a steel washer soldered to the right-hand end, and the washers each have a single notch on one side of the central hole. It is only when the slit on the hollow shaft and the notches on the washers are aligned that the 'key' can be inserted or withdrawn.

This alignment is achieved, of course, by rotating the drums so that the correct combination of symbols appears at the front, on the same level as groups of lines engraved on the side-pieces.

1. *Cf.* Tanavoli & Wertime 1976, p.116, no.259; Rome 1989, nos 134, 135.

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335, 336
Two combination padlocks
Iran, 19th century

Steel and brass, forged and sheet, engraved, 4.4 × 4.2 cm and 4.7 × 4.2 cm
accession nos SC1274, SC1327

Both locks have a horizontal mechanism similar to those of cat.333 and cat.334, but they have a rounded, hinged shackle. Cat.335 is a four-drum example in which the two middle drums only were made from brass sheet, while cat.336 has three drums, and both the drums and attached washers were fabricated from brass sheet. In both cases the rest of the lock is of steel.

337, 338
Two combination padlocks
Iran, 19th century

Steel and brass, forged and sheet, engraved, 5.5 × 2.2 cm and 7.7 × 2.5 cm
accession nos SC1326, SC190

In these two padlocks the vertical mechanism is composed of three brass drums, with a washer attached on one side, rotating about a vertical axle, within a steel casing. The top of the casing has a crown-shaped bracket for the shackle. One end of the shackle is hinged to the bracket, while the other end is hinged to a toothed key, which may be slid vertically in and out of the drums, but only when the symbols engraved on the drums are arranged in the correct combination.[1]

For cat.337 it is sufficient to align the two figures /2/ on the top two

drums to release the mechanism – the third drum appears to be merely conventional. Furthermore, on cat.338 the bottom drum appears to be fixed, but this cannot be tested, as the combination required to open the padlock has not been established.

1. Tanavoli & Wertime 1976, p.43, pp.116–17; Rome 1989, no.138.

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337

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339–342
Four combination padlocks
Karand, near Kirmanshah,
20th century

Brass and steel, cast and forged, engraved, measuring between 3.1 × 3 cm (cat.342) and 6.2 × 4.8 cm (cat.339)
maker Ibrahim
accession nos SCI328, SCI329, SCI330, SCI92

Cat.339–41 were signed by the maker, Ibrahim, with a stamp applied to the side of the casing, and cat.342 is so similar in form that it may be attributed to the same workshop. Ibrahim is known to have produced locks at Karand, near Kirmanshah in western Iran, until the 1960s.[1]

All four locks have a horizontal mechanism and a hinged shackle, but the lock operates in a different manner to cat.335 and 336. When the correct combination of letters is lined up with the marks engraved on the casing, the right-hand side-piece is loosened, so that the shackle is released, but the side-piece and the attached shaft cannot be fully retracted.

1. Tanavoli & Wertime 1976, p.116; Wertime 1977, p.159, F.

342

343

343
Combination lock
Probably Iran, 19th or 20th century

Steel and brass, cast and sheet, engraved and stamped, 6.2 × 6.7 cm
accession no. SCI364

This lock is very similar to cat.335 and 336 in form, but the six drums are stamped with letters of the Latin alphabet rather than Arabic numerals. An anomaly is that the letters are upside-down when viewed from the front of the lock, that is, the side engraved with the marks for the alignment of the letters.

One side of the lock is engraved with the number '7' and the French word DÉPOSÉ. But the lock may have been made in Iran, where a similar example in an Italian collection was acquired.[1]

1. Rome 1989, no.137; *cf.* no.121, also marked 'DÉPOSÉ'.

340

341

344
Casket with a dial-operated combination lock
The Jazirah, first half of the 13th century

Brass, cast and sheet, inlaid with silver, 19 × 18.5 × 14 cm
accession no. MTW 850
provenance Christie's, 10 October 1989, lot no. 526
published Fehérvári & Nassar 1993, p. 40

On top of the lid of this casket are four dials, with rotatable pointers, which formed part of a combination lock. In his comprehensive work on elaborate water-clocks and automata,[1] al-Jazari describes and illustrates 'a lock for locking a chest by means of 12 letters of the alphabet', that is, a dial-operated combination lock. Only five Islamic caskets are known which have this type of lock, including the casket described here. Of the others, a casket in an anonymous collection in New York is of similar appearance to the Khalili item and, like it, is neither signed nor dated. It has a field divided by thin lines of copper inlaid in the brass, the surface of which is otherwise inlaid with silver, which suggests it was produced between the mid-13th and the early 14th century, in the Jazirah.[2] Fragments of a casket in the David Collection, Copenhagen, are signed by Muhammad ibn Hamid al-Asturlabi al-Isfahani and dated AH 597 (AD 1200–1).[3] A casket in the Museum of Fine Arts, Boston, bears an inscription that, on the basis of the inscription on the fragments in Copenhagen, can be intepreted as a signature by the same maker, with the date AH 593 (AD 1196–7). Finally, a casket in the treasury of Sint Servaas, Maastricht, is dated *circa* AD 1200 and, unlike the previous examples, which are made mostly of brass inlaid with silver, is of ivory and brass.[4]

It has been argued that al-Jazari wrote his treatise between AH 595 (AD 1198–9), when he entered the service of Nasir al-Din Mahmud (who became king at Diyarbakr two years later) and AH 597 (AD 1200–1201).[5] Of the two dated caskets, both of which were probably made in Iran, the one in Boston and dated AH 593 predates al-Jazari's service with Nasr al-Din by two years.

Designs and descriptions of several different items are given in the sixth 'category' of al-Jazari's book, and among these is the account of the lock. Each of the caskets listed above has four dials for the lock, like that described by al-Jazari, but only the two caskets made by Muhammad ibn Hamid have the double form of the dials, where a pointer on the diameter of a rotatable dial is set to an underlying dial scale on the casket lid before the knob with a pointer above is set to the upper dial scale, the correct setting of all dials and pointers enabling the lock to be released.

Al-Jazari's reference to 12 letters of the alphabet relates to the four sets of dials which, in his version of the mechanism, each have three-letter combinations. It is clear that combination locks with dials already existed, because al-Jazari claims only to have made improvements in the design: 'The earlier [workers] in this craft made locks for locking and opening by means of the letters. Among them were [those that] locked by means of 4 letters on 4 circles, by 2 letters on 2 circles, and by 6 letters on 6 circles. I made a chest (*ṣundūq*) and made a lock on its lid, as I shall describe. It is four circles on a long rectangle and inside this circle is [another] circle. Between them are sixteen lines and between the lines are sixteen of the twenty-eight letters.'[6] Given al-Jazari's historical and geographical context, it would be reasonable to seek a Byzantine model for his combination lock.[7] The dials on the other caskets are simple, with just one scale on the casket, to which a rotatable pointer is set.

Al-Jazari uses 16 of the 28 letters of the Arabic alphabet, restricting himself to those which vary in shape, and omitting the pointed variants, which would be easily confused. The order of the letters on the dials drawn in manuscript copies of al-Jazari's treatise and on the Sint Servaas casket is that of *abjad*, whereas the two caskets made by Muhammad ibn Hamid have letters in the normal order of the Arabic alphabet, perhaps suggesting that a word code was used in the latter case. Setting the single or double dials to a predetermined combination of letters (it must be remembered that the letters can represent either an *abjad* number of not only single digits but also tens, hundreds and a thousand, or a more readily memorized word) aligns recesses in discs inside the hinged lid, enabling a slider with lugs on its surface to be slid far enough so that the lugs enter the recesses, and the slider then releases the lock. The discs and knobs are retained by a wedge (as for the alidade and plates on an astrolabe, see Part One, pp. 200–201 above), which permits rotation, tension being provided by slight convexity of the discs inside the lid. The casket described here lacks any mechanism, which seems to have been removed, though it is possible that the knobs and scales were dummies to suggest that the casket would be difficult to open without a code; the lower ends of the knobs (and the end of the central toggle, which presumably operated the slider) have been filed flat and they are now retained in place by transverse pins. On the inside of the lid of the casket in New York, centred between the arbors of the four knobs (two of which are missing, while of the other two one is stuck and the other moves freely, though both appear to have been damaged), there is a disc that was perhaps notched for the slider; this disc is attached to the arbor which terminates in a central knob on the top of the lid, which, in the absence of a keyhole, served to open the casket; damage to the casket is thought to have occurred from forced entry. The surviving casket made by Muhammad ibn Hamid and now in Boston retains its original mechanism, and the fragments by the same maker, in Copenhagen, also include much of the mechanism.[8]

The Khalili casket, and that in New York, are the only ones from the Jazirah. The surface of the casket is decorated in inlaid silver with a variety of scenes showing princely activities, as found on metalwork from the Jazirah; the scene in the medallion on the back of the casket is unusual in that it shows two men playing backgammon. The decoration includes scrollwork, sun motifs, and benedictory inscriptions.[9]

The casket in Boston, made by Muhammed ibn Hamid in AH 593, includes wood in its inner structure, to support and strengthen the metal sheets of which it is composed. There remain no traces of wood among the fragments of his later casket, in Copenhagen, nor is there any evidence that wood was used in the construction of either the New York or the Khalili caskets. Joining the plates with brackets alone results in a certain flimsiness.

Over 250 years after the interest in caskets with combination locks in the Jazirah and in Iran, *circa* 1200, a very small casket was made in Italy in what must be the same tradition; it was given as a wedding present to a Jewish bride.[10] The lid of this parcel-gilt silver casket (*cofanetto*) decorated in niello has two rows of eight sun-shaped dials with pointers and a flower-shaped boss in the centre, and a keyhole in the front panel. The four dials on the right are numbered using letters of the Hebrew alphabet as numerals, from 1 to 12; the two upper dials on the left are numbered from 1 to 10 only; and the other two from 1 to 11. Italian inscriptions, in the Venetian dialect, are written in Hebrew script on each dial; these inscriptions form an inventory of linen in a Jewish household in Italy during the Renaissance, listing 'sheets', 'tablecloths', 'women's chemises' and so forth. It is supposed that the casket was used to hold the keys of a linen-closet and that the pointers on the dials were turned to indicate the number of each item that the household possessed,[11] possibly as a precaution against theft by persons unable to read the Hebrew script. The casket is apparently signed by one Jesurun Tovar, possibly of Iberian origin, who probably made it in north Italy *circa* 1460–80, using the Askenasi Gothic script.[12] It appears to be unique among *cofanetti nuziali* and, though the dials and pointers are simply mnemonic, recording an inventory rather than operating any locking mechanism, in layout and design, even to the central boss, the casket seems to continue part of the al-Jazari tradition. The route and vectors of that influence would be of considerable interest.
FRM

1. See al-Jazari–Hill; al-Jazari–al-Hassan.
2. We have to thank the owners for kindly sending us a photograph of the inside of the lid of their casket, and for providing information about it.
3. On the work of this astrolabist, see Maddison 1985, p. 149.
4. With the exception of the casket in New York, these caskets and fragments are discussed and illustrated in Maddison 1985. Al-Jazari describes the inlaying of brass with silver and red copper; see al-Jazari–Hill, pp. 191–5; Ward 1985, pp. 78 and 80.
5. Ward 1985, *passim*, esp. p. 74.
6. Quoted from al-Jazari–Hill, p. 199.
7. Compare the history of the geared calendar movement described by al-Biruni; see Field, Hill & Wright 1985.
8. Because this casket lacks any mechanism, the principle only has been described. For details, see al-Jazari's account in al-Jazari–Hill; al-Jazari–al-Hassan; and Maddison 1985, pp. 148–59.
9. The casket as an item of metalwork is more fully described in Fehérvári & Nassar, forthcoming; see also Fehérvári & Nassar 1993, p. 40.
10. Now in the Jewish National Museum Bezalel, Israel National Museum, Jerusalam; see Narkiss 1958. We wish to thank Miss Daisy Raccah-Djivre, Associate Curator, The Skirball Department of Jewish Art, The Israel Museum, Jerusalem, for drawing our attention to this most interesting article, and for ordering photographs of the casket. It is also illustrated in Davidovitch 1968, p. 18.
11. For a possibly fifteenth-century Yiddish manuscript calendar with clock-like designs with pointers for recording linen, see Narkiss 1958, p. 294 and n. 48.
12. Narkiss 1958, pp. 293 and 294, and n. 47.

344, top and side views

345, 346, 347

348, 349, 350

345–350

Six pairs of scissors

Ottoman, 18th or 19th century

Steel blades, hollow-ground and damascened in gold on the outside, engraved silver handles, 25.9 × 3.9 cm
accession no. SCI113

Steel blades, hollow-ground, damascened in gold outside and in, brass handles, 28.6 × 5.5 cm
accession no. SCI124

Steel blades, hollow-ground and damascened in gold on the outside; the brass handles have hinged sections kept in position by steel springs, one now broken, 27.7 × 2.8 cm
accession no. SCI147

Steel blades, forged and hollow-ground, the exterior blackened and damascened in gold, brass handles, 26.5 × 4.7 cm
accession no. SCI257

Steel, forged, the blades hollow-ground and damascened in gold on the outside, 25.7 × 4 cm
accession no. SCI121

Steel, forged and filed, damascened in gold, 19.7 × 4.9 cm
accession no. SCI119

These six pairs of scissors are of two distinct varieties.

Cat.345–349 are paper scissors of the type that occurs in sets of calligrapher's tools.[1] They have long, ribbed, hollow- ground steel blades of fairly standard form, and in most cases the handles were made separately and screwed on; cat.349 is an exception.[2] The handles vary greatly in form and material, but there are a number of well-defined groups. One such, exemplified by the handles of cat.346 and cat.348, is of brass and takes the form of an invocation of one of God's names, *Yā Fattāḥ* ('O Opener!').[3]

Cat.350, on the other hand, is closer to contemporary European scissors, for it has solid blades and integral handles.[4]

1. See, for example, the sets SCI310, SCI264 and SCI263 in the Khalili Collection (Geneva 1995, nos 159, 172, 186).
2. Another example in the Collection is SCI293 (Geneva 1995, no.164).
3. Other examples in the Collection are SCI123, SCI148, SCI314; *cf.* also four further pairs of scissors, SCI120, SCI122, SCI132 and SCI149, that have handles of different form.
4. Another example in the Collection is SCI112.

351

Scissors

Iran, 19th century

Steel, forged and cast, the blades hollow-ground and damascened in gold on the outside, 26.5 × 5.4 cm
accession no. SCI254

352–354

Three pairs of scissors

Iran, 18th or 19th century

Forged steel, with hollow-ground blades and pierced, filed and engraved decoration, 13.8 × 1.7 cm
accession no. SCI138

Watered steel, forged and turned, with hollow-ground blades and pierced and filed decoration, 18.7 × 5.1 cm
accession no. SCI105

Watered steel, forged, with hollow-ground blades and pierced and filed decoration, brass rivet, 16.1 × 2 cm
accession no. SCI116

Cat.352 is engraved at the top of each blade with two parts of a Qur'anic quotation, from verse 13 of the surah *al-Ṣaff* (LXI), 'Help from God and a speedy victory'. Cat.353 has very fine arabesque designs in openwork,[1] as does cat.354, the handles of which have stems of a complex baluster shape and loops that are surmounted by a pair of doves. Handles of the same type are found on a pair of scissors dated AH 1220 (AD 1805–6).[2]

1. *Cf.* four other pairs of scissors in the Khalili Collection, SCI111, SCI117, SCI118, SCI139.
2. Pope 1938–9, pl.1390, C; see also pl.1390, A.

355–357

Three pairs of pincers

Iran, 19th century

Steel, forged and filed, 10.4 × 4.3 cm, 8.5 × 4.3 cm, 11 × 4.7 cm; cat.357 is set with turquoises
accession nos SCI75, SCI72, SCI142

The Khalili Collection includes four other pairs of pincers of the same type (SCI70, SCI71, SCI73, SCI74).

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Scissors

Iran, 19th century

Steel, cast and sheet, the blades hollow-ground, decorated with silver overlay and brass 'eyes', 6 × 18 cm
accession no. SCI141

These bird-shaped scissors are in three parts. Two consist of a blade and a handle made as one piece. Each blade forms one half of the long bill; the two are attached by a pin at the eyes. One handle forms the body of the bird and sports two legs and a long tail which allow the bird to stand up on flat surfaces. It also has a loop for a finger on its underside. The other handle forms the wings and has two slots to take the third element, a loop that normally rests inside the first loop but can be pulled out when the scissors are in use.

359

Combined pincers and penknife

Iran, 19th century

Steel, sheet and cast, damascened in gold, 11.7 × 4.5 cm
accession no. SCI55

360

Folding knife

Iran, 19th century

Steel sheet, the exterior damascened in gold, 13.3 × 1 cm (open), 7.4 × 1 cm (closed)
accession no. SCI56

361

Awl

Iran or the Ottoman empire, 19th century

Steel sheet and wire, filed and forged, damascened in gold, mother-of-pearl, brass sheet, copper and damascened steel rivets, 19.6 × 1.1 cm
accession no. SCI157

The awl is a leatherworker's tool of great antiquity, and examples surviving from the Islamic period are often associated with sets of bookbinder's tools.[1]

1. Bosch, Carswell & Petherbridge 1981, p.43; Haldane 1983, fig.20.

362

Candle-snuffers

Iran, 19th century

Steel, sheet and cast, damascened in gold, 17.2 × 5 cm
accession no. SCI140

The top of the snuffers is damascened with an inscription in Persian that reads *bandah-i Shāh-i vilāyat 'Abbās*

Detail of seal in MSS972

('The servant of the King of Guardianship, 'Abbas'), the king in question being the Imam 'Ali. This legend was engraved on the seal of Shah 'Abbas I of Iran (r. 1588–1629), and impressions of it appear on an early 14th-century *Masālik wa'l-mamālik* manuscript in the Khalili Collection (MSS 972). The same legend was used by Shah 'Abbas II (r. 1642–1666; see cat.376), and the prestige attached to the name of Shah 'Abbas I meant that his seal was widely employed as a decorative motif on metalwork and other wares in the 18th and 19th centuries. It is notable that the arrangement of the words in the version on the snuffers has been reversed: the Shah's name appears at the top, while on the seal itself it was humbly placed beneath the allusion to 'Ali.

363

Shears

Iran, 19th century

Forged steel, damascened in gold, 11.3 × 4 cm
accession no. SCI165

The blades of these tiny shears can be opened only to a maximum of 1.8 cm, because of the steel spring between the handles.

One side of the blades is damascened with leafy tendrils, while the other bears a couplet in Persian, 'In truth the Lord is the Possessor of all things; this custody is ours for a few days only.'

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Tongs

Perhaps eastern Iran, 14th century

Copper alloy, probably hammered, with drilled, filed and punched decoration, 21.6 × 5 cm
accession no. SC1126

These tongs may be compared with another pair of the same type in the Khalili Collection (SC1127).

365–370

Six pairs of tweezers

India, 19th century

Steel and brass sheet, with pierced and, in the case of cat.365, engraved decoration, measuring between 7.4 × 2.2 cm (cat.365) and 2.9 × 1.1 cm (cat.370)
accession no. SC1276A–F

368

These six pairs of tweezers are each equipped with a spike, and they were probably used for removing thorns or splinters from the feet. In the case of cat.365–7 and cat.370 the brass upper section and the steel spike are hinged to the top of the tweezers, whereas the steel upper sections of cat.368 and cat.369 are rigid, and the spikes are fixed between the tweezers; the spike of cat.368 may be extracted by unscrewing the upper section.[1]

1. The same type of openwork appears in a pair of tweezers in the Khalili Collection, SC167, which is closer to cat.372 in form.

371–374

Four pairs of tweezers

Iran, 19th century

Steel sheet and wire, with milled decoration, 13.1 × 2.3 cm (closed) 17.6 × 2.3 cm (with spike extended)
accession no. SC1143

Forged steel sheet, with filed, pierced and incised decoration, 16.6 × 1.9 cm
accession no. SC1154

Forged steel sheet, 16.4 × 3 cm
accession no. SC164

Steel, forged and turned, with decoration blued in reserve, 17 × 0.7 cm
accession no. SC1259

Cat.371 and 372 are furnished with a button which runs up and down the slot in the centre of the handle, to open and close the tweezers.[1] The same feature appears in two other pairs of tweezers in the Khalili Collection (SC161, SC1110). In the first of these, as in cat.371, the button is attached to a spike (compare cat.365–70).

Cat.374 is of the same type as a pair in the jeweller's box of scales, cat.375, where they were no doubt used for picking up the finest jewellery elements. In the box there are compartments for three other types of tweezers that are now lost. They include one for a pair that must have been very similar in form to cat.373.[1]

1. *Cf.* also three other pairs of tweezers in the Collection, SC165, SC166, SC1172.

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Shears
India, 19th century

Steel, cast and forged, decorated with silver overlay, 29.3 × 4.1 cm
accession no. SC159

This form of shears has been current from very ancient times and was used primarily in wool and textile production. The decoration of this example is specifically Indian in style, although a very similar pair of shears has been published as Italian, perhaps Venetian, work of the 16th century.[1]

1. Houston 1966, no.196.

376
Leather knife
Iran, mid-17th century

Steel blade, cast, watered, pierced and damascened in gold, and bone handle, 13.3 × 4 cm
maker 'Ali Riza Narak
accession no. SC160

This beautiful knife was designed for paring leather in the preparation of bookbindings and other wares. In one of the marginal paintings executed *circa* 1600–10 for the Jahangir Album, for example, a knife of the same shape is shown lying beside an awl (see cat.361) on a bookbinder's bench.[1]

The shaft of cat.376 was hollow-cast and contains a small ball. On the top it is damascened with the legend, *bandah-i Shāh-i vilāyat 'Abbās-i thānī* ('Servant of the King of Guardianship, 'Abbas II'; compare cat.362), and on the lower side with the maker's signature, *'amal-i 'Alī-Riḍā'-i Nārak* ('The work of 'Ali Riza' Narak').

376, details showing inscriptions on shaft

'Abbas II ruled Iran between 1642 and 1666, and it seems that 'Ali Riza was a member of a family of metalworkers who worked for the Safavid court throughout the 17th century. Kamal al-Din Mahmud Yazdi Narak carried out repairs to the shrine of the Imam 'Ali al-Rida in Mashhad in AH 1015 (AD 1606–7) for Shah 'Abbas I,[2] while a pierced and damascened steel *maqṭa'*, or plaque for cutting pen nibs, was signed by a second Kamal al-Din Mahmud in AH 1108 (AD 1696–7).[3]

In another inscription by this metalworker, on a steel plaque made in AH 1107 (AD 1695–6), he names 'Ali Riza as his father;[4] it therefore seems likely that 'Ali Riza was the son of the first Kamal al-Din Mahmud and was perhaps named in honour of his father's work on the Imam's tomb, and that the second Kamal al-Din Mahmud was named after his grandfather.

1. Bosch, Carswell & Petherbridge 1981, p.45, fig.5. The Khalili Collection has another knife of this type, SC1203.
2. Karimzadeh Tabrizi 1985–91, II, p.550, no.811, where the name was read as Kamal al-Din Mahmud Yazdi Nazil.
3. Pope 1938–9, pl.1390, F (see also D); Karimzadeh Tabrizi 1985–91, II, p.550, no.810.
4. Momtaz 1995, no.55, where the name was read as Kamal al-Din Mahmud ibn 'Ali Riza Narzuk; see also Christie's, London, 27 April 1995, lot no.304.

376

377
Dividers
Iran, 19th century

Forged steel, filed, 27.3 × 18.4 cm
accession no. SC126

The shaped points of the dividers are detachable, being held in place by two screws. A third screw can be used to hold the arms open at a set position on the arc.

The Khalili Collection contains two other pairs of dividers (SC169, SC144).

378
Measure
Iran, 19th century

Forged steel, blued and punched, 52 cm long, 1.6 cm wide at tips
accession no. SC163

The measure is hinged, expanding to 52 cm when fully extended. Its length is divided into eight equal sections of 6.5 cm, marked by a heavy line and four small rings, and these divisions are subdivided into sixteen equal lengths of 3.25 cm, marked by a light line and one small ring.

Another, similar example in the Khalili Collection (SC162) is 55.4 cm long and is divided into eight and sixteen lengths of varying accuracy. A third, plainer specimen is contained in cat.379 and consists of two halves that slot together. It is 54.6 cm long and is divided in the same manner.

All three measures are about one cubit, or one *dhar'*, in length. The differing lengths could be explained by the variations current in Iran before the standardization of weights and measures, but the inaccuracies in the subdivisions suggest that these were never intended as precision instruments.

377, 378

379

Box of scales

Iran, *circa* 1820

Wooden box, 44.9 × 26.7 × 12.8 cm, with carved, painted and varnished decoration and printed cotton cloth covering the base; brass and steel fittings; a wooden drawer in the base; and a removable wooden board, with steel sheet reinforcement beneath, divided into 31 fitted compartments, one covered by a hinged brass lid, 4 × 3.7 cm, three lined with red velvet; the board contains three sets of scales of steel, brass, tinned copper and red and purple silk; three sets of weights of steel, brass and tinned copper; various steel implements; a casket of steel and mirror glass, 10.9 × 6.8 × 4.9 cm; and a carved and painted wooden box, 11.6 × 6.9 × 1.6 cm
maker Nasir
accession no. SC1106

Tool boxes embellished with lacquer painting were made in Iran from at least the 18th century onwards.[1] This example, which was almost certainly made for a merchant who traded in jewellery or small quantities of precious metal, is decorated on the outside with a design of scrollwork bearing a variety of flowers, all carved in relief and enhanced with colour. On the top of the box, though, this carved work is confined to a central medallion and corner-pieces, and the field between them has small birds and flowers scattered on a gold ground. The inside of the lid bears a scene from the romance of *Yusuf and Zulaykha'* showing the use of scales under the supervision of Zulaykha's husband and his servant Yusuf.

Whereas cat.380 below was used only for the storage of scales, this box was designed both for this purpose and for the storage of a jeweller's valuable wares. It is therefore provided with a number of security devices. The two keyholes in the front of the box give access to two steel locks with alarms attached. The locking actions are probably both of the bent-spring type (see above, p.376), but they were operated by two different keys. In both cases the key had a hollow bit, which fitted over a pin within the lock. As the key was turned to release the catch or catches, it also turned the pin, which operated the alarm mechanism on the inside of the lock. The pin in the left-hand lock is attached to a cog, which activates a hammer, which strikes a bell. The pin in the right-hand lock is attached to a cog with a pin that strikes the ends of four coiled springs.

Opening the lid reveals the top of the box, which is filled with a thick wooden board, painted red and green. This has 31 shaped compartments, one of which was made for a lockable steel casket, painted green on the inside and with a mirror fitted into the lid. Other items could be stored in a large drawer in the base of the main box, which could only be released once the lid had been raised. It was then necessary to pull up two long steel pins with bulbous heads (one now lost) which passed down through the right-hand wall of the box and through the front of the drawer.

The box contains three sets of scales of different sizes. All three have a steel balance beam (24.3 cm, 14.3 cm and 9.9 cm long) from which the concave tinned copper pans (10.8 cm, 4.9 cm and 3.4 cm in diameter) are suspended by silk cords (approximately 29.5 cm, 20 cm and 13.5 cm long). Each beam is equipped with a vertical tongue, which indicates that equilibrium has been reached, and a pivoted shackle, by which it is suspended, both of pierced steel.[2]

The smallest of the three sets is contained within its own wooden box, which has the same type of carved and painted decoration as the main box. The body of the small box has three fitted compartments, one for the balance, one for the pans, which is lined with red velvet, and one with eight recesses for a set of tiny, tablet-shaped, tinned-copper weights, which are held in place by a hinged brass lid (4.7 × 3.9 cm), which once had a catch. The unit employed for the weights was a carat (*qīrāṭ*) of approximately 0.20 grams;[3] the pieces for 1, 2 and 8 carats are missing, but those for 3, 4, 16, 24 and 32 carats survive.

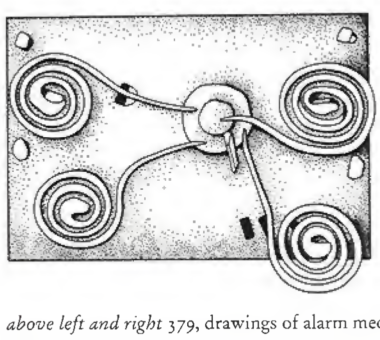
The set of weights in the small box are one of three. The main set consisted of 12 steel pieces, with brass and pierced steel mounts. The unit employed was a *mithqāl* of 4.46 grams.[4] The heaviest, octagonal piece weighs 100 *mithqāls*, and the sequence continues with weights of 75, 50, 30, 20, 10, 5, 4, 3 and 2 units. The two smallest pieces, which are probably replacements, weigh 4.46 grams (1 *mithqāl*) and 5.79 grams (30 carats).

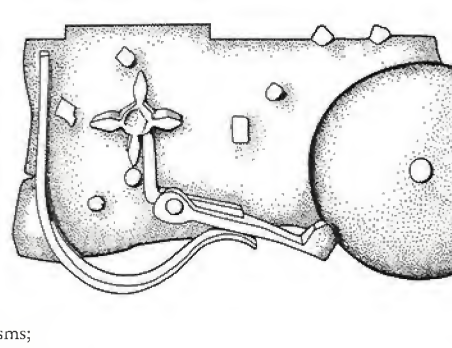
The third set are also of steel but are in tablet form. The four largest had recesses of their own in the wooden board, but only two survive; one, the heaviest, weighs 64 carats, while the other is marked '2' and weighs approximately 2.32 grams. Five other weights are kept in the adjacent compartment with a hinged brass lid. The unit here appears to be a grain (*ḥabbah*) of approximately 0.05g, and there are pieces for 1, 8, 12, 16 and 32 grains.[5]

Other compartments in the board are for a two-part linear measure (see cat.378) and for four pairs of tweezers of different types (three now lost; see cat.371–4). The final two compartments are for a two-part steel bar with a hook at one end in the form of a dragon's head with a bird issuing from its mouth. When assembled this bar can be screwed into a steel mount on the lid of the box, and one of the scales suspended from it.

All three sets of scales are stamped with the seal of the maker, Nasir, which includes the date AH 1235 (AD 1819–20). On the largest scales this stamp appears at both ends of the balance beam, while on the other two it was applied in the centre of each pan. The same seal also appears on the hinged brass lids that cover one of the compartments in both the main box and the small box for the smallest set of scales.

1. Khalili, Robinson & Stanley 1996, Part One, no.90, which was produced in 1773 but has lost its implements. For 19th-century examples, see, among others, Pope 1938–9, pls 1391–2; Mahboubian 1970, no.1481; Wulff 1966, p.63, fig.90; and a spectacular box in the British Museum, London, inv. no. 1927.5-25.1.
2. See Wulff 1966, p.63.
3. The carat was a twenty-fourth part of a *mithqāl*, and the larger weights in the box show that the *mithqāl* used here had its *shar'ī* value of 4.46g (see below). The carat should therefore have weighed approximately 0.186g. This discrepancy, and others noted below, remain to be explained.
4. Hinz 1970, p.5.
5. All such identifications are based on approximate readings, to only the second decimal point, and are therefore open to amendment.





above left and right 379, drawings of alarm mechanisms;
extreme right detail of the bar for the largest of the three balances

380

Box of scales
Iran, *circa* 1850

Wooden box, 25.2 × 14.8 × 5.1 cm, painted and varnished inside and out, with engraved brass sheet, brass wire and pierced steel fittings; the interior has 14 shaped compartments, one covered by a hinged brass lid, 1.9 × 2.2 cm, which contain two pairs of scales, of steel, brass and green, purple and blue silk, and weights of steel and brass
maker Mirza Baba
accession no. LAQ169

The lid of the box is decorated with a hunting scene from a Persian romance, surrounded by a frame of flower-filled cartouches with a dark-green ground. Similar floral motifs appear on the sides, against a black ground, while the inside of the lid has a row of vases on a red ground.

The box contains two sets of scales similar to those in cat.379. They have steel beams (20.1 cm and 10.8 cm long), concave brass pans (8.8 cm and 4.7 cm in diameter) and silk suspension cords (approximately 19.5 cm and 14.5 cm long). There were originally nine steel weights, but two were evidently lost, and two much smaller brass weights now take their place. The unit of weight employed was the *mithqāl* of 4.46 grams, and the pieces for 1, 2, 3, 10 and 20 *mithqāls* survive; the missing pieces were probably for 4 and 5 *mithqāls*. The compartment with a hinged brass lid may have contained smaller weights, as in cat.379, but it is now empty.

The two pairs of scale pans were stamped in the centre with the seal of the maker, Mirza Baba, which is dated '5621'. This may be interpreted as a reversed, Persian form of the *hijrī* date 1265, equivalent to AD 1848–9. The scales must therefore have been made in 1848 or later.

380, top of lid

380, interior

381

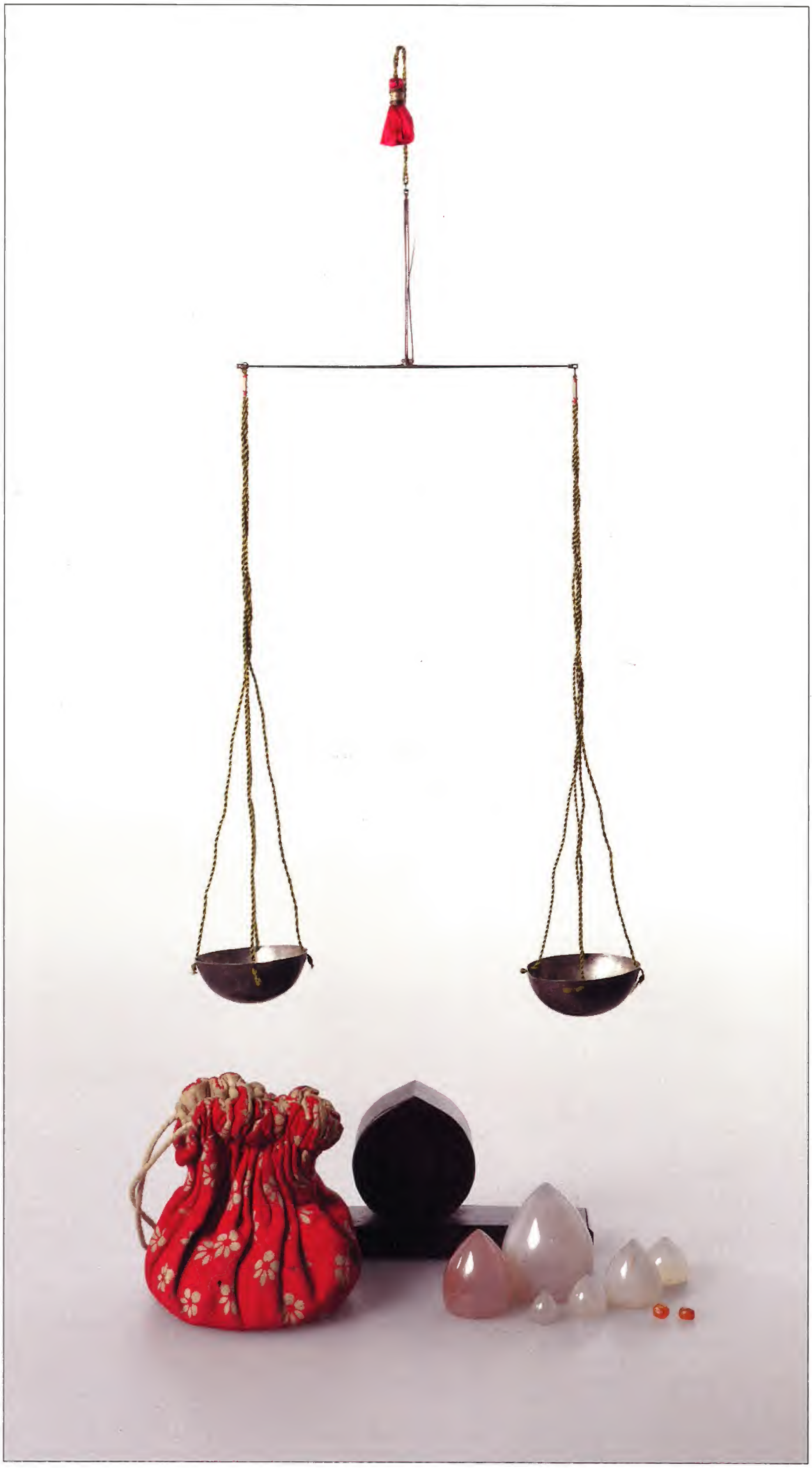
Scales

India, AH 1277 (AD 1860–61)

Beam, tongue and shackle of steel wire, the beam 8.6 cm long, suspension cords of green silk with a purple silk tassel, pans of hammered silver, 2.9 cm in diameter; in a case of copper-alloy sheet, engraved, the inside painted with a brick-red pigment, 4.3 × 9.2 × 2 cm; with eight agate weights, the largest 2.9 cm high and 2.4 cm in diameter, in a pouch, approximately 6.5 cm high, of printed cotton with a lining of natural cotton and a drawstring
maker Muhammad Jan or Muhammad Khan
accession no. SCI426

381, detail showing inscription on case

These tiny and beautifully made scales can only have been used by a jeweller or other dealer in precious materials sold in small quantities. The weights are based on the *mithqāl* of 4.46 grams. The six larger pieces are for 5, 2 and 1 *mithqāls* and 12, 6 and 3 carats. The two smaller pieces weigh less than 0.1 gram and probably had a value of one or two grains.



381

Appendix 1
Modern Indian globes

by Emilie Savage-Smith

The Indian workshop of Balhumal, as well as those of other 19th-century instrument-makers, produced well-made Islamic celestial globes demonstrating design and production techniques inherited from earlier Islamic craftsmen, but their products make no pretence of being anything other than modern instruments that continued a medieval tradition. Other metalworkers in India in the 19th-century, however, were producing celestial globes with dates or maker's names that purported to be from an earlier period. One of the best examples is provided by the globe that was acquired by the Musée du Louvre in 1892.[1] It bears the date AH 684 (AD 1285–6) and the name of the maker Muhammad ibn Mahmud ibn 'Ali al-Tabari, but is evidently a copy of cat.123.

More recent Indian workshops have produced large numbers of celestial globes alleged to have been made by earlier makers. These instruments – most of them inscribed with dates and names intended to deceive – have been flooding the antiques market in recent years, and for this reason they are discussed briefly here.[2] The group in question comprises 24 known globes, seven of which are now in the Khalili Collection. Another globe in the Collection, cat.382, is clearly related, and its importance will become clear shortly.

While the design and metalworking practices shown in these modern Indian globes are in keeping with medieval and early modern products, they are all distinguished by peculiar iconographic features that betray an early modern European influence as well as a misunderstanding of the significance of the original design of the celestial globe and of its function. Analysis suggests that they are all rather recent products, possibly of the same workshop, which – if this is the case – was one that experimented considerably in the use of alloys and in methods of construction.

These globes present only the classical Ptolemaic constellations, and their design incorporates many features of Mughal and Indian dress and other artistic conventions. The influence of early modern European celestial cartography on them is not, therefore, immediately apparent. However, a clue to the possible origin of this series can be found in a manuscript produced in India in the first half of the 19th century. The Sanskrit treatise *Sarvasiddhāntattvaçūḍāmaṅi* or *Jewel of the essence of all sciences* was written sometime between 1833 and 1839 by Durgashankara Pathaka, an astronomer of Benares (Varanasi), and presents a horoscope for the prince Nau Nihal Singh of Lahore (1821–40). Its 293 folios contain a great deal of astrological and astronomical material as well as a large number of illustrations, including four planispheric maps of the heavens. Two of these maps show non-Ptolemaic constellations.[3] The other two present hemispheric maps of the Ptolemaic constellations, one with the autumnal equinox at the centre, the other with the vernal equinox at the centre,[4] and are directly related to the celestial globes under discussion.

The mathematical projection employed in these maps is unusual in terms of Islamic cartography, as is the delineation of the Milky Way, both features suggesting a European model. It is the rendering of the constellation forms, however, that is the most significant characteristic. The human figures show a mixture of late Mughal and Indian elements. Auriga, for example, has certain Persian features and Cepheus wears an 18th-century Iranian hat, while Hercules and Serpentarius both wear a dhoti, the loincloth worn by male Hindus, particularly in southern India. The anachronistic result is unlikely to be earlier than the 19th century,[5] a dating which fits well with the fact that the Sanskrit manuscript was produced sometime between 1833 and 1839.

All these constellation diagrams are carefully reproduced in fine detail on a celestial globe now in the Khalili Collection, cat.382, which bears a date of AH 1067 (AD 1656–7) and is stated to be made by or for one Munshi 'Abd al-Shahid, astrologer and divinator.[6] This globe is important because it was apparently the model for the series to be discussed below. The fact that it reproduces in detail the unusual constellations on the 19th-century Sanskrit map is reason alone to question the authenticity of the date on cat.382, and other features are also questionable. The use of Delhi instead of Shahjahanabad to refer to the city of manufacture seems incongruous on a product supposedly made during the reign of Shah Jahan. The spacing of the figures on the globe suggests that the maker was transferring the design from a two- to a three-dimensional surface, and had trouble retaining correct proportions and spacing. Corona Australis, for example, is represented by a small, plant-like object (as in the Sanskrit map) but it is far away from Sagittarius, and Andromeda is far from Pegasus, with which it ordinarily shares a star. It seems likely that either the maker of the globe used as a pattern the very maps prepared by Durgashankara Pathaka,[7] or that both artisans had access to the same early 19th-century model. Moreover, the number of stars and their positioning on the celestial globe are nonsensical, no stars are labelled, nor are any of the constellations other than the zodiacal ones.

The globemaker added carefully graduated bands for the ecliptic and equator that were missing from Pathaka's maps because of the method of projection employed. These bands are inscribed in a distinctive fashion that is reminiscent of European rather than Islamic instrument-making. The graduations of the equator and ecliptic have been numbered to read from the south, rather than from the north, proceeding in a clockwise rather than anticlockwise sequence. Furthermore, the bands are blank where they pass over the constellation figures, a feature typical of metal European globes of the 16th century, which does not in itself invalidate the stated date of the Khalili globe.[8] Yet the manner in which the constellation figures are rendered, entirely derivative of Pathaka's map or his exemplar, rules out a 17th-century origin. In fact, the iconography alone implies a 19th-century workshop.

Elements of the iconography of this globe extend throughout the dependent series of globes. Several constellations are represented in a unique manner that is characteristic of this group. For example, Cassiopeia is depicted as a woman sitting with her legs drawn up and her ankles crossed, holding an umbrella or parasol over her head. Argo is a square-hulled ship whose masthead is not in the form of an animal head, as is customary, but a man's face, bearded, moustachioed and turbaned. Also in the southern hemisphere, on the back of the long serpent Hydra, there is a curious version of the constellation Crater, which in this case resembles a large, wide-rimmed cooking-pot covered with a rounded lid.

Most distinctive of all, however, is the constellation of Auriga, which is given a radically new interpretation. He is shown as a bearded man sitting almost cross-legged, with two small animals held in his arms. This image is in great contrast to the usual depiction of a clean-shaven man holding reins or a staff in his hand, either standing or sitting with both knees drawn up (as illustrated, for example, on the globes cat.123 and 138 above). The unusual version of the constellation displayed on this set of globes and on the Sanskrit manuscript must have come from contact with Europe, where a slightly different iconographic tradition had been maintained.

In the classical Greek world two images were associated with the area of the sky between the Pleiades and the Great Bear. The first, that of the charioteer Heniochus (in Arabic, *mumsik al-a'innah*, 'He who holds the reins'), was the image that determined al-Sufi's diagram, which in turn formed the basis of Islamic images for this constellation.[9] The second was that of a goat with a group of young goats or kids. This imagery was not incorporated into the standard Islamic diagrams of the constellation, but was reflected in the star names. The large star on the western shoulder is Capella (α Aurigae, the sixth brightest star in the heavens), and its Arabic name *'ayyūq*, while of obscure meaning, may have derived from a Babylonian word for a goat. Two other stars close together on the western arm were called *al-jadyān* ('the two kids'), and al-Sufi added that the star at the elbow of that same arm was named *al-'anz* ('the goat').[10] These three stars form an asterism that even today is known as 'the Kids' (εηζ Aurigae). In an influential astronomical and meteorological poem, the Greek poet Aratus (*circa* 315 BC–240 BC) placed the Goat on the Charioteer's left shoulder and the young goats or kids at his waist. Aratus's poem inspired numerous illustrated Latin versions, where the constellation was called Auriga. One of the earliest and most beautifully illustrated of the surviving examples is a Carolingian manuscript that appears to be a faithful copy of a mid 4th- or 5th-century version; in it Auriga is shown standing with his front leg slightly bent, carrying a staff in his right hand, a goat perched on his left shoulder and two kids held in his left hand.[11]

The poem by Aratus underwent several translations and adaptations (known collectively as *Aratea*), and the possible influence that illustrated copies may have had on constellation imagery in the Islamic world has received little consideration by historians.[12] The original Greek poem by Aratus was translated into Arabic early in the 9th century AD and was used in a universal history titled *Kitāb al-'Unwān* ('The Book of Models') written in AH 330 (AD 941–2) by Agapius (or Mahbub) who lived in Manbij, a Syrian town north-east of Aleppo. The Latin and vernacular adaptations apparently remained unknown in the Islamic world. It is not known whether the copy of Aratus's poem that was translated into Arabic was illustrated, and consequently it is difficult to determine its impact on Islamic constellation iconography.

What is evident, however, is that this image of Auriga with one or more goats became part of the early modern European tradition of celestial cartography. It can be seen, for example, on a star map of the northern skies in a Latin parchment manuscript, *De composicione spere solide*, probably copied about 1440 in Austria.[13] This parch-

ment map is closely related to a celestial globe made 40 years later, probably by Hans Dorn, a Dominican monk in Vienna, and both reflect a prototype that served as a direct source for Albrecht Dürer's woodcut celestial maps executed in 1515.[14] Thereafter, the majority of European star maps and engraved gores for celestial globes depicted Auriga with at least one goat, usually resting on his left shoulder. The 1603 revised edition of the earliest celestial globe designed by the Dutch cartographer Willem Janszoon Blaeu (1571–1638), for example, depicts Auriga as a nude kneeling figure, viewed from behind, with two goats resting on his shoulderblades.[15] On the planispheric map produced by Blaeu's son, Joan, Auriga is draped in a tunic, still kneeling, with one larger goat on his left shoulder.[16] On some star maps the skies were represented geocentrically, so that the figures are drawn frontally. This is true, for example, of planispheric maps by Georg Bartsch (1600–1633) and Carl Allard (1648–1709) and also of a map drawn by William Schickard (1592–1635), who was an astronomer and mathematician as well as a professor of Oriental lanuages at the University of Tübingen.[17] In these cases Auriga is fully clothed, usually in soft flowing robes, kneeling or sitting on his legs, and holding two goats in his left arm.

In the Sanskrit map and cat.382 the goats have become nondescript four-legged animals with pointed ears, held one in each arm by a figure sitting nearly cross-legged. In all the later globes in this group, the ears of the little animals lengthen into those of a long-eared rabbit or hare. The inclusion of this albeit modified European iconography makes it likely that an early modern European star map or even a celestial globe reached India. That such European material was available in India by the middle of the 19th century is clear from an Urdu translation of al-Qazwini's *Kitāb 'ajā'ib al-makhlūqāt* ('Marvels of things created') that was lithographed at Lucknow in 1869, in which all the constellations are clearly taken directly from a European source.[18]

It seems indisputable that either cat.382 or an unknown predecessor directly or indirectly influenced the design of the other globes in this series. The makers of the dependent globes combined the distinctive design elements evident on cat.382 with labels, approximate star positions and other features that characterize products of the principal workshop in Lahore in the 16th and 17th centuries (see Part One, p.219).

The most important diagnostic guide to the dependent group of globes is the figure of Auriga, which bears a striking resemblance to that on cat.382, though there are some differences in detail, including the placement of what looks like a book over Auriga's two hands. Another readily identifiable feature of this group of globes is the treatment of the head of Serpentarius; his cranium appears to be missing, with the forehead rising to a point at the top. This appears to be a rendering of the hairline beneath the centrally parted and smoothed hair on Serpentarius as shown on cat.382. A third distinctive feature is the zodiacal figure Capricorn, the interpretation of which, unique to this series of globes, is of unknown origin. Capricorn's lower body is not that of a fish, as was customary, but a four-legged, hoofed male animal with a stubby tail and upright horns that are thick and knobbly. In the southern hemisphere, the silhouette of Crater, on the back of the serpent Hydra, is the same as that on the Indian globe cat.382, but larger, its base merging with the back of the serpent. All the globes are missing the forty-eighth constellation, Piscis Austrinus.

Cat.383 and 384 appear to be Indian products, judging from their seamless construction. This would also be a reasonable location for the workshop given that the design incorporates 17th-century Mughal elements with Indian iconography of the 19th century. They represent probably the earliest versions of the basic design and were produced by better engravers, though both are unsigned and undated. The maker of cat.383 clearly had experience making scientific instruments. On the other hand, cat.384, which is crafted of silver with gold stars, had had transferred onto it constellations identical in detail and size to those on cat.383, but its greater diameter results in an increase in space between the constellations that destroys the globe's utility. Both objects appear to be relatively recent products and may have been made by the same maker. The corrosion around the silver stars on cat.383 is consistent with the use of a corrosion bath for artificial ageing. Oddly, cat.383 and 384 each have a dent with a very similar texture, as if both were dropped on the same surface, or hit with the same hammer.[19]

The five remaining derivative globes in the Khalili Collection, and the sixteen similar ones elsewhere, are clumsy and inaccurate copies of these more carefully executed seamless globes. As well as seamless globes, globes made of hemispheres were produced in India, as evidenced by cat.138, the globe by Muradabadi made in AH 1257 (AD 1841–2).[20] The lack of understanding of the Arabic or Persian inscriptions on the derivative globes certainly suggests an Indian Hindu workshop. This is further supported by the fact that the stand for the genuine Tatawi globe (cat.134), made by a Hindu craftsman either in 1767 or 1802, when the *devanāgari* labels were added to the globe, is related in design to one of the two types of stands (both non-functional) associated with this group of late globes.[21] It is likely that some time after the construction of its stand, the genuine Tatawi globe came into the possession of the workshop that made the large group of globes we have described here. This would account for Tatawi's name being used on some of the globes made later in the workshop. Why names associated with Iran or implying an Iranian connection (such as Nasir al-Din al-Tusi or 'Ali Isfahani) would have been placed on some is more difficult to explain.[22] It is, of course, possible that these clearly related products are in fact Iranian rather than Indian, but the nature of the engraved script and the misunderstanding of the Arabic or Persian suggests strongly otherwise.

That all these globes, whatever the quality of their workmanship, were produced as attractive salon objects rather than as serious instruments seems indisputable. That they are all 19th- or even 20th-century Indian products – no matter what date or name occurs on them – and possibly all from a single workshop, seems probable given the evidence available. The highly decorative design and often innovative alloys compensated for their lack of precision. The production of eye-catching, even jewel-bedecked, globes is referred to by one traveller to Iran in the 19th century. In her journals, published in 1891, Isabella Bird says that she saw in the Shah's 'Museum' in Tehran a gold terrestrial globe, with countries outlined in rubies and diamonds, resting in a stand and rings of gold.[23] All the globes in this distinctive series are celestial rather than terrestrial and were probably produced in India rather than Iran, but the same market for beautiful and unusual, but not necessarily functional, instruments remains. The appearance of considerable numbers of these celestial globes in European art markets over the past few years testifies to the continued interest in attractive objects whose functionality and authenticity have, however, been given little attention.

1. Paris, Musée du Louvre, Section Islamique, inv. no.6013; see Part One, p.170.
2. A more detailed discussion of the alloys, the methods of construction and the iconography of these globes, as well as a comparison of the 24 known examples comprising this group, will be published separately.
3. London, British Library, MS.Or.5259, fols 59a and 60a, illustrated in Savage-Smith 1992, pl.2 and p.70, fig.2.51.
4. London, British Library, MS.Or 5259, fols 56v and 57r; see Savage-Smith 1992, pp.68–70; Snyder 1984, pp.136–7; Losty 1982, pp.154–5.
5. This is the opinion of Andrew Topsfield, Department of Eastern Art, Ashmolean Museum, Oxford, regarding both the iconography of globe cat.382 in the Khalili Collection and that of the Sanskrit manuscript.
6. The name *Munshī* in Persian means 'writer' or 'secretary' and was often used as a Hindu name; see Schimmel 1989, p.56; Philips 1951, p.54.
7. Durgashankara Pathaka may only have been the author of the treatise and horoscope, while the skilled artist who prepared the maps remains anonymous.
8. See, for example, the clock-driven celestial globe that is part of an astronomical clock made by Philipp Imbser (or Immser) of Göttingen in 1555 for Emperor Charles V (Bertele 1961, p.25).
9. For examples, see Wellesz 1959, fig.8.
10. See Savage-Smith 1985, pp.151–2; Kunitzsch 1961, no.47.
11. Leiden, University Library, MS.Voss. lat.Q.79, fols 22v, known as the Leiden *Aratea*; see Katzenstein & Savage-Smith 1988, p.23.
12. See Savage-Smith 1992, pp.15–18, for a discussion of its possible influence upon the design of the 8th-century Syrian domed ceiling at Qusayr 'Amrah.
13. Vienna, Nationalbibliothek, Bild-Archiv und Porträt-Sammlung, cod.5415, fol.168r. This manuscript is also important in illustrating early European knowledge of Islamic constellation imagery; see Savage-Smith 1992, pp.60–61 and fig.2.43.
14. Savage-Smith 1992, pp.60–62. Dürer's maps have been frequently reproduced; see, for example, Snyder 1984, pp.52–3; Warner 1979, pp.72–3.
15. See Savage-Smith & Wakefield 1994, pp.248–8 and fig.1.
16. For illustrations, see Snyder 1984, p.108, and Warner 1979, p.27.
17. See Warner 1979, pp.224, 14–15, and 2–3 respectively.
18. Qazwini, *'Ajā'ib al-makhlūqāt*, translated into Urdu by Amjad Husayn from a Persian translation made for Ibrahim 'Adil Shah in AH 954 (AD 1547–8); a copy is in the British Library. See p.44 for Auriga, shown frontally wearing a Roman toga, with knees slightly drawn up and a large goat on his chest.
19. Another unsigned and undated globe, whose present location is not

known, is nearly identical to cat.383. It was incorrectly catalogued as a 17th-century globe in Savage-Smith 1985, pp.240–41, no.43. For an illustration, see the catalogue of a sale at Nouveau Drouot, Paris, 9–10 October 1980, p.177.
20. Globes characterized by this distinctive iconograpy could not, however, have come from the Muradabadi workshop, for the technique for joining hemispheres employed by Maradabadi was different, and he used a square cutter when engraving, which contrasts with the techniques used in these globes.
21. The stand for cat.134 allows for a meridian ring, and can function properly.
22. Three globes are recorded as having the maker's name of Nasir al-Din al-Tusi: that published in the catalogue of a sale at Christie's, South Kensington, 6 July 1994, lot no.21; another sold at Christie's, London, 26–28 April 1994, lot no.382; and one that in June 1990 was at Ghavani Antiques, London. All three globes are engraved with the date AH 1205 (AD 1790–91). The globe with the name 'Ali al-Isfahani, dated AH 1117 (AD 1705–6), is cat.386.
23. Bird 1988, I, p.200.

382

Celestial globe

India, allegedly AH 1067 (AD 1656–7)

High-zinc brass (globe); leaded tin brass (stand)
diameter 20.62 cm
diameter of horizon ring 21.0 cm inner, 26.4 cm outer
height of stand 14.7 cm
weight 1.35 kg (sphere only)
accession no. SC1284

A three-line Persian inscription in the southern hemisphere of this globe gives the opening verse of the *Shahnāmah* of Firdawsi[1] followed by the name Munshi 'Abd al-Shahid, astrologer and divinator (*munajjim wa-jaffār*), with Delhi and the date AH 1067 (AD 1656–7) in the last line. Whether Munshi 'Abd al-Shahid is intended to be a maker's name or an owner's name is unclear, but in any case, the date, for reasons explained in the essay above, cannot be taken as genuine.

The globe reproduces on a metal sphere virtually all the details of the multi-coloured Sanskrit manuscript painting of a planispheric celestial map discussed in the essay (see fig.19). The maker has also engraved bands to represent the ecliptic and equator that were not shown in the Sanskrit painting. The bands are designed so as to run over the constellation figures, with no details visible beneath, and with the equator passing *under* the ecliptic. Ecliptic latitude-measuring circles are also added as well as a number of Arabic/Persian labels that are not part of the Sanskrit map. The Milky Way is clearly indicated, as it was in the Indian miniature, but labelled *kahkashān*, its common Persian name.

Many of the other labels are confused or incorrect. For example, the solstitial colure is twice labelled *madār-i saraṭān* or Tropic of Cancer. The ecliptic latitude-measuring circle passing through the equinoxes is four times labelled *mu'addil al-nahār*, the traditional term for the celestial equator, and the actual celestial equator bears the modern term *khaṭṭ-i istiwā'*. The ecliptic is at four places labelled *madār al-shams*, 'circle of the sun', but *madār* is the usual term for a lesser circle and not a great circle.[2] No stars are labelled and neither are any of the northern and southern constellations. Although each zodiacal constellation is labelled, none of the zodiacal houses are.

382, detail of the figure of Auriga

Figure 19 Drawing after Sanskrit map of the heavens (British Library MS.Or.5259, folio 56v), detail showing the figure of Auriga

The ecliptic and equator are carefully and precisely graduated by single degrees, with every fifth degree a longer line and every tenth labelled with standard Arabic numerals. The equator is numbered by 10 degree-intervals continuously from the vernal equinox but in a clockwise rather than the standard anticlockwise direction. The numbering of the ecliptic repeats every 30 degrees but also proceeds clockwise from the vernal equinox, though the sequence of the zodiacal signs is anticlockwise. The numerals on both the ecliptic and equator read from the south rather than from the customary north.

Stars are indicated by silver inlaid points at some places and by brass points at others, in no consistent pattern. The star positions are so imprecise that they do not correspond to any epoch. In some constellations, such as Ursa Major, there are far too many stars, and in others the interval between stars is too great. Andromeda, for example, does not share a star with Pisces as it should, but instead they are separated by a great distance.

The globe was made of two hemispheres, joined along the ecliptic by a one-inch wide, internally soldered collar. There is a brown colour to the surface of the sphere due to some surface treatment. Most of the engraved labels are filled with a white substance. The execution of the circles and graduations is good, but the nonsensical star positions make the instrument non-functional.

The stand in which the globe rests is of unusual design and is of a different alloy. It is identical in design and alloy to those stands associated with 'astrologer's globes' (a distinctive type of globe discussed in Part One, see pp.160–65). The horizon ring makes no allowance for a meridian ring, and a true celestial globe placed in such a ring cannot function. The ring is precisely the same size as those of the 'astrologer's globes,' and it seems likely that either cat.382 was made by the same workshop that produced the 'astrologer's globes,' or it lost its original rings and only later came into the possession of such a workshop.

1. Firdawsi–Levy & Banani, I, p.1, line 1.
2. See Savage-Smith 1985, p.66.

383, detail of the figures of Auriga and Perseus

384, detail of the figures of Auriga and Perseus

383

Celestial globe

India, 19th century

Leaded tin brass, with inlaid silver studs
diameter 18.83 cm
weight 1.75 kg
accession no. SCI14
published Savage-Smith 1990, pl.6

This unsigned and undated globe appears to be the earliest, or at least the most carefully executed, in a large series of closely related globes. The iconography and general design combine important elements from those displayed on cat.382 with others found on globes produced by the workshop in Lahore that operated in the 16th and 17th centuries (see Part One, p.219).

The circles and graduations are precisely and carefully inscribed. The star positions, especially near the ecliptic and equator, are to a large extent in keeping with those used by the Lahore workshop, though most have been shifted one to one-and-a-half degrees. There is not, however, a consistent increment and some remain unchanged. Such a shift might indicate an attempt to produce a globe that would apply to the mid-18th century.

The ecliptic and equator are graduated by single degrees with every sixth degree indicated by a longer line and labelled with *abjad* letter-numerals, the equator numbered anticlockwise in two 180°-segments and the ecliptic repeating every 30 degrees. In addition to the ecliptic latitude-measuring circles, there are inscribed the equinoctial colure, the two tropic circles, two equatorial polar circles, and two ecliptic polar circles, all of which are labelled with the customary Arabic terms. The constellations and many of the stars are also labelled in Arabic. The inside edges of both the ecliptic and equator bands and the lines between every six degrees are formed of dotted lines re-engraved with a solid line. This same technique was employed in engraving the solstitial colure, the equinoctial colure, the tropic circles, and the equatorial polar circles.

The globe is a seamless sphere. Three circular plugs have been soldered into place and are very evident along the equator. The stars have been indicated by hammering a silver plug into a pre-drilled hole and then marking it with a dotted circle punch. The stand and rings are missing.

384

Celestial globe

India, 19th century

Silver, with inlaid gold studs
diameter 21.89 cm
weight 5.45 kg
accession no. SCI 8

This undated and unsigned globe copies every detail of cat.383, including circles, graduations, labels, and the method of engraving, to the extent that all the constellations must have been transferred onto this sphere by pouncing or some other method of precise copying; only the diameter and the alloy differ. The transfer, however, made no allowance for this being a larger sphere, so as a result there is an inordinate amount of space between the individual constellations. The foot of Perseus, for example, no longer touches the elbow of Auriga, and Pegasus no longer shares the star in the head of Andromeda. The result, of course, destroys any approximation to astronomical accuracy.

The metalworking techniques used to produce this globe are impressive, however, both in the making of the seamless sphere with no plugs readily visible and in the careful transfer of the individual constellation figures.

The globe is made of an alloy that is 97.64% silver but also has the unusual contaminent of zinc. The walls appear to be very thick and the weight is considerable, suggesting that it may be silver plated. On the other hand, there is no evidence of surface deterioration as one might expect from an applied surface. X-rays reveal one plug soldered into position at the head of Pisces; there is also one chaplet of a different alloy. The stars are indicated with inlaid gold plugs placed into a pre-drilled hole and then punched over with a dotted circle punch. The incised lines are filled with a black substance.

The ring associated with this globe is of nearly the same composition as the sphere, but does not contain any zinc. The brackets attached to the ring are typical of the non-functional horizon ring and stand often found with the derivative globes.

385, detail of the figure of Serpentarius

384, 385, 382 (left to right)

385

Celestial globe

India, 19th century

Leaded high-zinc brass
diameter 20.4 to 21 cm
diameter of meridian ring 21 cm inner, 23.5 cm outer
weight 3.45 kg
accession no. SCI15

This unsigned, undated globe was made of uneven hemispheres joined along the bulging rib of the equator. The radiograph indicates that the two hemispheres were fixed to each other by at least two internal studs and then soldered, using a technique similar to that used on cat.386, which also belongs to this group. The diameter of the resulting sphere measured north–south is greater than that of the equator. The extremely high zinc content of the alloy (over 40%) indicates a surface-enriched brass, similar to that forming the base of cat.386. The surface was decuprified to enrich the zinc and bring out a silvery, white metal colour which is still evident in places. The surface is also very etched, indicating that it has been aggressively cleaned in the past. The incised lines are filled with a black material.

The ring associated with the sphere has brackets attached that are associated with other globes of this style (such as cat.384) and is of a somewhat different composition, in that it has slightly less zinc and tin, half the amount of lead and a little silver. The stand is missing.

386

Celestial globe

India, bearing the date AH 1117 (AD 1705–6)

High-nickel brass
diameter 24.9 cm to 26 cm
height overall 53 cm
weight 3.80 kg
signed 'Ali al-Isfahani
accession no. SCI7

The globe is formed of two irregular hemispheres, probably cast, and now joined near the equator, held by at least five internal studs and soldered together. The globe is very elongated and not truly spherical. The alloy employed is a very unusual high-nickel brass, sometimes called *p'ai-tung*, and the engraving on the globe is filled with a white particulate compound. The globe sits on a pin in the base of a pillar stand and is held fast at the top by a screw with an elongated handle that is of the same alloy as the globe. The other four components of the stand are made of a brass with a very high zinc content (over 40%), similar to that of cat.386 itself. The surface of the stand was decuprified in order to match the silvery appearance of the high-nickel brass forming the globe. The screw securing the globe is a Whitworth screw. The lower part of the stand is secured on the wider base by a wing-bolt screw on the underside. The bulbous part of the stand is engraved with human and animal figures including a variant of Auriga with the two rabbits and a book, along with a small crescent moon and letters of unknown significance. The incised lines on the stand are filled with a black substance.

386, detail of the figure of Capricorn

388, detail of the figures of Crater and Corvus on the back of Hydra

386, 383, 388 (left to right)

387
Celestial globe
India, 19th century

Leaded high-zinc brass, with inlaid silvery studs
diameter 15.1 to 15.3 cm
weight 1.45 kg
accession no. SC1164

The undated and unsigned globe is made of hemispheres joined along the ecliptic. The ground behind the constellations, circles and labels has been cut back, producing the effect of shallow relief with cloudbands holding the labels. The numerals in the graduations read from the south. There are circular, silvery studs soldered into the globe at the celestial poles. At the southern ecliptic pole there is a large hole 1 centimetre in diameter. The stand and rings are missing.

388
Celestial globe
India, bearing the date AH 1177 (AD 1763–4)

Silver
diameter 26.1 cm
diameter of horizon ring 26.5 cm inner, 28.9 cm outer
height of stand 18.3 cm
weight 7.60 kg (sphere only)
accession no. SC1269
published Christie's, South Kensington, 27 September 1990, lot no.194

No maker's name is given on this globe, which is made of a quite pure silver that is inconsistent with its stated date. The radiographs show that the sphere was cast in hemispheres and joined at a seam along the equator. Both axis holes are 1.2 centimetres in diameter with a circular collar insert that reduces the diameter of the hole to 0.9 centimetres.

The non-functioning silver stand consists of a horizonal ring, graduated but not numbered, supported by four slightly curved but flat-sided legs resting on an eight-lobed ring base. At opposite points there are two brackets soldered to the top of the horizon ring. Through each of them there passes a silver pin 4.2 centimetres long with a bulbous head that secures the celestial poles to the horizon ring. There is no allowance in the horizon ring for a meridian ring.

389
Celestial globe
India, bearing the date AH 1073 (AD 1662–3)

Gold
diameter 9.9 cm
weight 0.60 kg
signed Muhammad Salih Tatawi
accession no. SC1268

This gold or gold-plated globe is also constructed of cast hemispheres joined along the ecliptic. At the north celestial pole there is a hole 0.4 centimetres in diameter, at the south celestial pole a hole 0.5 centimetres in diameter, and at the south ecliptic pole a larger one 0.8 centimetres in diameter. The signature and date occur near the north ecliptic pole. Several constellations are missing: Ursa Minor, Draco, Cepheus, Hercules, Serpentarius, Serpens and Corona Borealis in the north, Pisces and Cancer among the zodiacal signs, and Orion, Hydra, Crater and Corvus in the south. Ursa Major is drawn facing the wrong direction, and the placement of the other northern constellations is scrambled; Sagittarius is also out of sequence. The numerals on the graduations read from the south. The stand and rings are missing.

A second globe with similar iconography and the same date is recorded as having the identical maker's name, Muhammad Salih Tatawi,[1] but is apparently made of brass rather than gold.

1. Sarma, Ansari & Kulkani 1993, pp.59–60 and figs 1, 2 and 5.

387

387, detail of the figure of Cassiopeia

389

Appendix II
Metallurgical analyses of celestial globes
by Emilie Savage-Smith

Few scientific artefacts bear documentary information about where and when they were made; even fewer have been discovered in securely dated excavation contexts. Scientific analyses of objects, when combined with art-historical and textual evidence, can sometimes provide clues as to their place or time of production. Radiography can determine casting, hammering, and soldering techniques which occasionally are distinctive to particular workshops or time periods, while elemental analysis of an alloy can provide additional evidence. For example, some innovations in metallurgy have directly affected the composition of copper alloys, while certain unusual alloys, such as high-nickel brass, are associated with specific regions and periods. Production and restoration techniques incongruous with a stated date on an object require further explanation before an object can be accepted as authentic.

The scientific analysis of objects can, then, add another dimension of evidence to that provided by the historian and palaeographer. In most cases the combined evidence of these different disciplines will lead to the same conclusions regarding an object, and indeed, in the case of most of the items in the Khalili Collection that were submitted to scientific examination, there were no major contradictions.[1]

As the composition of a metal, and often the construction of the object itself, cannot be accurately determined from visual inspection alone, metallurgical analyses have been conducted on all the celestial globes and related instruments that are now in the Khalili Collection.[2] X-ray fluorescence analysis was used to determine the composition of alloys, radiographs to determine the method of construction.

While there are advantages in applying modern technology to the analysis of early technology, it is important to bear in mind some limitations. In the first place, x-ray fluorescence analysis is a surface technique that analyzes only a very thin layer (less than 0.1 millimetre), and as such it cannot be used to determine the thickness of silver or gold plating. This limitation has particular bearing on the Khalili globes cat.384, 388 and 389, for without a core analysis one cannot evaluate the composition of the entire sphere. Secondly, results can sometimes be affected by the way in which the surface of the object has been treated or by a chemically produced patina. The results can also be misleading on corroded metal. Thirdly, the technique is not sensitive enough to measure low concentrations such as trace elements, that is, anything less than 0.1%.

Moreover, for the globe apparently of iron, cat.115, the technique is not appropriate, for iron is a non-homogeneous alloy and x-ray fluorescence is not a useful guide to its composition. The area sampled in x-ray fluorescence is extremely small, and this may be particularly troublesome in the case of an alloy with a substantial lead component, for lead tends to segregate and could be missed in the sample, or may vary considerably between multiple samples. To compensate for this, more than one sample point was usually examined, though in the following tabulation only second testings in areas that were visibly different are noted.

A topic that has been of considerable interest is whether the percentage of zinc in a copper alloy can be a guide to the age or provenance of an artefact. The method of alloying copper with zinc that was employed in the medieval Islamic world as well as in Europe was the 'cementation process' in which copper was combined with zinc (either as the natural ore, calamine, or as zinc oxide that was purified from calamine by sublimation) by heating them together in a crucible. The resulting zinc content of such an alloy could vary considerably, but only up to a maximum of 28%. In such 'pure brasses' there was less than 2% each of lead and tin in the alloy.[3] Alloys with higher proportions of zinc would require the direct addition of metallic zinc.[4] Evidence is now available that metallic zinc was produced in the Islamic world by the 16th century. Ottoman court vessels were made from an alloy consisting mostly of zinc, with only traces of tin, iron and copper.[5] The technique was discontinued in the Ottoman workshops by the end of the 16th century, but it carried on in the production of Bidri ware in India, where there was a considerable zinc production from the end of the 14th century.[6] Since it is evident that the production of metallic zinc was known in the eastern part of the Islamic world from at least the first half of the 16th century, the occurrence of high-zinc brasses amongst Islamic objects as early as the 16th century is not in itself cause to question their authenticity.

The compositions of the copper alloys employed in the Khalili globes generally corroborates earlier findings. The late 13th-century globe by al-Tabari (cat.123) is a 'pure brass' consistent with other products of the same age that have been examined. It was formed by hammering into hemispheres. Both of the 17th-century globes – the Mughal globe made in AH 1074 (AD 1663–4) and the slightly earlier Safavid globe (cat.134 and 143 respectively) – are made of brass with a zinc content within the limits of the cementation process, though the proportion of zinc is slightly greater than in the 13th-century globe, and there is some tin and lead in the alloys. Both globes were cast, one as a seamless sphere and one in thick-walled hemispheres. A similar alloy, with slightly more lead, was used for cat.383, which is the most carefully executed, and possibly earliest, of the closely related modern globes discussed in Appendix I.

In the case of the Qajar globe of AH 1212 (AD 1797; cat.151), the leaded tin-brass alloy has a much lower proportion of zinc and the quantities of lead and tin are high enough not to be accidental. An alloy of these proportions (11–12% zinc, 3–5% tin, 6.5–7.5% lead) is particularly useful for items cast and finished by lathe turning.[7] The Qajar globe was cast as a seamless sphere and is the only known example of a seamless globe produced by a maker apparently working outside the Indian subcontinent.

All the other copper-alloy globes in the Khalili Collection contain far more zinc than can be alloyed with copper by the 'cementation' process and would have required the addition of elemental zinc. On the basis of available evidence, this level of zinc would imply that they were made no earlier than the 16th century, and indeed other evidence indicates that they are all 19th-century or later products.

An important result of the tests is that they show that some workshops produced seamless cast spheres from alloys that are not highly leaded. It had been previously argued that such globes were made of a heavily leaded alloy, which has been termed a 'quaternary alloy', consisting of copper, zinc, tin and lead (12%–40%).[8] This assertion was based upon the examination of a single seamless globe made by one of the members of the 17th-century Lahore workshop (see Part One, p.219), Qa'im Muhammad, which was found to have over 30% lead. The new tests reveal, however, that about the same time that Qa'im Muhammad was making his globe in Lahore, Muhammad Salih Tatawi cast a seamless globe (cat.134) using an alloy with little over 1% lead, about 1.5% tin and just over 24% zinc. A brass of greater zinc content, requiring the addition of elemental zinc but about the same proportion of lead, was used by the Balhumal workshop in the first half of the 19th century to cast two of the seamless globes (cat.140 and 141).

We have not tested the idea that a given workshop would use, for a range of products, an alloy that was sufficiently consistent to allow identification on the basis of its components, for it has not been possible to analyze a large enough number of products from one workshop. Indeed, the reasoning has been that metal was often reused, particularly in the making of instruments, and that there would be no consistent pattern within a workshop.

Pertinent to this argument, however, are the virtually identical results obtained for the two modern astrologer's globes, cat.113 and 114, which must surely be from the same workshop (see Part One, pp.160–63). The stands associated with these two globes and also with globe cat.382 not only look almost identical, but their metallic composition yields nearly identical results. As these two probably 20th-century astrologer's globes (and their distinctive stands) yielded very similar results, and as the two 19th-century celestial globes from the Balhumal workshop (cat.140 and 141) also displayed internally consistent results (except for a modest variation in lead, which tends to segregate), this limited sampling points to some consistency in the elemental composition of alloys, and suggests that some groups of 19th- and 20th-century metal objects may not always have been produced from reused metal.

As for the celestial globes that are believed to be modern Indian products (see Appendix I), some of the alloys are unusual. Without the metallurgical tests, the fact that a high-nickel alloy, the Chinese *p'ai-tung*, was employed in one globe (cat.386) would have been overlooked, and this is an important discovery in the history of metallurgical techniques and their transfer. A curious result arose in the case of the silver globe (cat.384) that was apparently copied from cat.383, for its silver alloy had a component of zinc (1.26%) greater than that of copper. No other precedents are known for this composition, for zinc is an unusual contaminant for silver ore.[9] The use of a similar leaded high-zinc brass in two globes, cat.385 and 387, suggests a close relationship. The distinctive method of joining hemispheres with internal studs rather than an internal band was disclosed in the x-rays made of cat.385 and 386, again suggesting a common workshop. Radiographs also revealed in the case of cat.383 and 384 internal lathe-turning marks, suggesting that the internal core mould had been turned on a lathe and providing further evidence that these two pieces were produced in the same workshop.

The following tables present the metallurgical analyses of the celestial globes, astrologer's globes and astrologer's standard, showing elemental composition by relative weight percentages. Unless otherwise stated, the samples were taken from the body of the globe itself and not from the inlaid stars.

1. Only three major collections – the British Museum, the Ashmolean Museum, and the Freer Gallery of Art – have had elemental analyses conducted on most of their Islamic metalwork. (See Craddock 1990; Allan 1979, especially pp.143–52; and Atıl, Chase & Jett 1985). There has also been occasional testing of other individual items, and the present laboratory results are another small contribution to building a larger body of comparative data regarding the metallic alloys used in Islamic metalwork.
2. With the exception of the iron globe, cat.115 which was unsuitable for this type of test.
3. Atıl, Chase & Jett 1985, p.37; Craddock 1990; Craddock 1979; Allan 1979, pp.39–45.
4. In Europe in 1723 an improved process for cementation was patented by Nehemiah Champion, manager of the Bristol brass company, that permitted an increase of zinc up to 33% of the alloy; see Day 1990, pp.137–8.
5. See Atıl, Chase & Jett 1985, pp.29–30, and 37–8; and Craddock *et al.* 1990, p.55.
6. See Craddock *et al.* 1990, pp. 52–5; Stronge 1985; La Niece & Martin 1987.
7. It is an alloy that is used even today in machining; see Atıl, Chase & Jett 1985, pp.37, 43 n.8, and 149–54.
8. Savage-Smith 1985, p.98; *cf.* Savage-Smith 1990, p.27. For the term 'quaternary alloy', see Allan 1979, pp.149–50. Craddock has objected to this term, arguing that the amount of tin (2% to 4%) is too low to be a deliberate component; see Craddock 1979, p.73.
9. The values for iron and nickel in this case result largely from the analytical set-up and should not be considered a feature of the globe.

Celestial globes

Catalogue no.	Cu	Zn	Sn	Pb	As	Ag	Au	Sb	Ni	Fe
123*, hemisphere	78.0	21.60	—	0.20	0.20	—	—	tr	—	—
143, hemisphere	71.24	24.60	1.75	1.81	0.14	—	—	tr	0.18	0.27
134†, no seam	72.18	24.68	1.43	1.07	tr	—	—	tr	0.12	0.40
151†, no seam	76.90	11.77	3.15	7.05	0.20	—	—	0.23	0.31	0.38
151§	75.05	12.13	4.79	6.74	0.35	—	—	0.34	0.26	0.33
151,stand	76.76	20.96	tr	2.04	—	—	—	tr	—	0.13
138†, hemisphere	64.14	35.24	—	0.47	—	—	—	—	tr	tr
140, no seam	59.34	36.10	1.36	2.29	tr	—	—	tr	0.11	0.57
140, stand	67.28	31.43	0.12	0.84	tr	—	—	tr	—	0.20
141†, no seam	59.91	38.61	0.11	0.62	tr	tr	—	tr	0.10	0.48
141¶	60.61	38.30	0.13	0.44	tr	tr	—	tr	0.16	0.18
141, stand†	63.81	34.58	0.54	0.62	tr	tr	—	tr	0.29	tr

Modern Indian celestial globes

Catalogue no.	Cu	Zn	Sn	Pb	As	Ag	Au	Sb	Ni	Fe
382, hemisphere	63.11	36.34	tr	tr	tr	—	—	tr	0.34	tr
382, stand	80.44	6.53	5.08	7.15	tr	—	—	0.39	0.14	0.25
383†, no seam	70.75	23.31	1.29	4.03	—	—	—	0.11	0.19	0.32
384† no seam	0.69	1.26	—	—	—	97.69	—	—	tr	0.33
385†, hemisphere	53.48	40.31	0.47	4.46	—	—	—	tr	0.38	0.88
386†, hemisphere	42.54	42.45	0.15	0.61	—	0.29	—	—	13.36	0.60
387†, hemisphere	52.88	40.42	1.27	4.24	tr	—	—	—	tr	1.01
389†, hemisphere	0.98	—	—	—	—	0.60	98.42	—	—	—
389**	8.02	—	—	—	—	2.31	89.67	—	—	—
388†, hemisphere	27.65	—	—	—	—	72.35	—	—	—	—

Astrologer's globes

Catalogue no.	Cu	Zn	Sn	Pb	As	Ag	Au	Sb	Ni	Fe
113†, hemisphere	63.15	36.53	—	—	—	—	—	—	0.27	tr
113, stand	82.39	3.54	2.67	10.79	—	—	—	0.27	0.18	0.16
114†, hemisphere	64.28	35.26	—	—	—	—	—	—	0.27	0.19
114, stand	80.56	4.55	3.12	11.16	—	—	—	0.29	0.14	0.18

Astrologer's standard

Catalogue no.	Cu	Zn	Sn	Pb	As	Ag	Au	Sb	Ni	Fe
112†, hemisphere	64.24	34.64	1.05	—	tr	—	—	—	—	—

tr = trace
* X-ray fluorescence analysis conducted by the Research Laboratory for Archaeology and the History of Art, University of Oxford, by Catherine Mortimer.

† X-ray fluorescence analysis conducted by the Royal Armouries, HM Tower of London, by Brian Gilmour in collaboration with Heather L. Ecker. The instrumentation used was the Kevex system.

§ A second analysis was made at a different location on the sphere.
¶ A second analysis of the globe was done with a different standard from the first analysis.
** A second analysis was made where the gold plating (?) appeared to be thinner.

Appendix III
Star names

Cat. 143

ظهر دب الاكبر	α Ursae Majoris (Dubhe)
قراق [مراق] دب الاكبر	β Ursae Majoris (Merak)
الجون	ϵ Ursae Majoris (Alioth)
العناق	ζ Ursae Majoris (Mizar)
القائد	η Ursae Majoris (Alkaid)
رأس التنين	γ Draconis
سماك رامح	α Bootis (Arcturus)
نير الفكه	α Coronae Borealis (Alphecca)
رأس الجاثي	α Herculis (Rasalgethi)
نسر واقع	α Lyrae (Vega)
ذنب الدجاجة	α Cygni (Deneb)
منقار الدجاجة	β Cygni (Albireo)
[الـ] ـكف الخضيب	β Cassiopeiae (Caph)
رأس الغول	β Persei (Algol)
مرفاق الثريا	α Persei (Algenib)
عيوق	α Aurigae (Capella)
عنق الحية	α Serpentis (Unuk)
رأس الحوى	α Ophiuchi (Rasalhague)
نسر طائر	α Aquilae (Altair)
ذنب الدلفين	ϵ Delphini
جناح الفرس	γ Pegasi (Algenib)
رأس التوّم الموخر	β Geminorum (Pollux)
رأس التوّم المقدم	α Geminorum (Castor)
سماك الاعزل	α Virginis (Spica)
قلب العقرب	α Scorpii (Antares)
ذنب الجادي	δ Capricorni (Deneb Algedi)
قيطس جنوبي [ذنب القيطس جنوبي]	β Ceti (Deneb Kaitos)
قيطس شمالي [ذنب القيطس شمالي]	ι Ceti
[الـ] ـكف الجخماء	$\lambda\alpha\gamma\delta\xi\mu$ Ceti
	[represented by one large star]
يد [الجوزاء] اليمنى	α Orionis (Betelgeuse)
يد [الجوزاء] اليسرى	γ Orionis (Belletrix)
رجل [الجوزاء] اليسرى	β Orionis (Rigel)
رجل [الجوزاء] اليمنى	κ Orionis (Saiph)
شعرى يماني	α Canis Majoris (Sirius)
شعرى الشامي	α Canis Minoris (Procyon)
سهيل	α Carinae (Canopus)
فرد الشجاء	α Hydrae (Alphard)
جناح الغراب	γ Corvi (Gienah)
رجل قنطورس	α Centauri (Rigil Kent)

Cat. 151

سماك رامح	α Bootis (Arcturus)
نير الفكه	α Coronae Borealis (Alphecca)
نسر واقع	α Lyrae (Vega)
منقار الدجاجة	β Cygni (Albireo)
[الـ] ـكف الخضيب	β Cassiopeiae (Caph)
رأس الغول	β Persei (Algol)
مرفاق الثريا	α Persei (Algenib)
عيوق	α Aurigae (Capella)
قرن الثور	γ Aurigae = β Tauri
عنق الحية	α Serpentis (Unuk)
رأس الجوزاء [رأس الحوى]	α Ophiuchi (Rasalhague)
نسر طائر	α Aquilae (Altair)
ذنب الدلفين	ϵ Delphini
متن الفرس	α Pegasi
منكب الفرس	β Pegasi
جناح الفرس	γ Pegasi (Algenib)
سرة الفرس	δ Pegasi or α Andromedae
بتن الحوت	β Andromedae (Mirach)
رجل المسلسلة	γ Andromedae
الناطح	α Arietis (Ḥamal)
عين الثور	α Tauri (Aldeberan)
رأس التوأم الموخر	β Geminorum (Pollux)
رأس التوأم المقدم	α Geminorum (Castor)
قلب الاسد	α Leonis (Regulus)
الصرفة	β Leonis
ظهر الاسد	δ Leonis
سماك الاعزل	α Virginis (Spica)
قلب العقرب	α Scorpii (Antares)
ساق يمن [؟ ساق ساكب الماء]	α Aquarii
ذنب قيطس شمالي	ι Ceti
يد الجوز[اء] اليمنى	α Orionis (Betelgeuse)
يد الجوز[اء] اليسرى	γ Orionis (Belletrix)
رجل الجوز[اء اليسر]ى	β Orionis (Rigel)
اخر النهر	θ Eridani (Acamar)
شعرى يماني	α Canis Majoris (Sirius)
شعرى الشامي	α Canis Minoris (Procyon)
سهيل	α Carinae (Canopus)
الفرد	α Hydrae (Alphard)
فم الحوت	α Piscis Austrini (Fomalhaut)

Concordances

Concordance by catalogue number

Cat.1	MSS499
Cat.2	MSS387
Cat.3	MSS454.1–2
Cat.4	MSS873
Cat.5	MSS852.1–2
Cat.6	MSS329
Cat.7	MSS233
Cat.8	MSS776
Cat.9	MSS760.1–2
Cat.10	MSS973
Cat.11	MSS568
Cat.12	GLS454
Cat.13	GLS199
Cat.14	GLS324
Cat.15	GLS254
Cat.16	GLS252.1–6
Cat.17	GLS374
Cat.18	GLS375
Cat.19	GLS376
Cat.20	MSS556
Cat.21	MSS243
Cat.22	MSS300
Cat.23	MSS714
Cat.24	MTW621
Cat.25	MTW1443
Cat.26	MTW189
Cat.27	MTW188
Cat.28	MTW526
Cat.29	MTW1378
Cat.30	MTW192
Cat.31	MTW191
Cat.32	MTW1444
Cat.33	MTW190
Cat.34	MTW691
Cat.35	TLS6
Cat.36	MTW267
Cat.37	MTW265
Cat.38	MTW217
Cat.39	POT1433
Cat.40	POT1271
Cat.41	POT253B
Cat.42	POT253A
Cat.43	MSS759
Cat.44	MSS755
Cat.45	MSS756
Cat.46	MSS734
Cat.47	MSS735
Cat.48	LAQ477
Cat.49	TXT77
Cat.50	TXT87
Cat.51	MSS723
Cat.52	MTW897
Cat.53	MTW851
Cat.54	MTW1346
Cat.55	SCI116
Cat.56	SCI117
Cat.57	SCI118
Cat.58	TLS7
Cat.59	TLS15
Cat.60	TLS16
Cat.61	MTW320
Cat.62	TLS5
Cat.63	TLS49
Cat.64	TLS1958
Cat.65	TLS1959
Cat.66	TLS1956
Cat.67	TLS1920
Cat.68	TLS2610
Cat.69	TLS2622
Cat.70	TLS2615
Cat.71	TLS2614
Cat.72	TLS2466
Cat.73	TLS2611
Cat.74	TLS2616
Cat.75	TLS2613
Cat.76	MTW815
Cat.77	TLS2609
Cat.78	TLS4
Cat.79	TLS2624
Cat.80	TLS1957
Cat.81	TLS3
Cat.82	TLS11
Cat.83	TLS10
Cat.84	TLS9
Cat.85	TLS1860
Cat.86	TLS2707
Cat.87	MSS970
Cat.88	TLS28A
Cat.89	TLS32
Cat.90	TLS29
Cat.91	TLS33
Cat.92	TLS30
Cat.93	TLS31
Cat.94	TLS21
Cat.95	TLS22
Cat.96	TLS20
Cat.97	TLS18
Cat.98	TLS12
Cat.99	TLS26A
Cat.100	TLS26B
Cat.101	TLS27A
Cat.102	TLS27B
Cat.103	TLS24
Cat.104	TLS45
Cat.105	TXT225
Cat.106	MSS412
Cat.107	SCI135A–M
Cat.108	SCI33
Cat.109	MXD172
Cat.110	MXD205
Cat.111	TLS134
Cat.112	SCI266
Cat.113	SCI51
Cat.114	SCI43
Cat.115	SCI261
Cat.116	MSS375
Cat.117	MSS975
Cat.118	MSS358
Cat.119	SCI22
Cat.120	MTW825
Cat.121	SCI262
Cat.122	SCI1
Cat.123	SCI21
Cat.124	SCI158
Cat.125	SCI3
Cat.126	SCI36
Cat.127	SCI11
Cat.128	SCI13
Cat.129	SCI12
Cat.130	SCI283
Cat.131	SCI5
Cat.132	SCI10
Cat.133	SCI53
Cat.134	SCI45
Cat.135	SCI42
Cat.136	SCI29
Cat.137	SCI153
Cat.138	SCI4
Cat.139	SCI31
Cat.140	SCI285
Cat.141	SCI44
Cat.142	SCI47
Cat.143	SCI282
Cat.144	SCI161
Cat.145	SCI159
Cat.146	SCI160
Cat.147	SCI35
Cat.148	SCI19
Cat.149	SCI271
Cat.150	SCI6
Cat.151	SCI155
Cat.152	SCI30
Cat.153	SCI50
Cat.154	SCI27
Cat.155	SCI41
Cat.156	SCI40
Cat.157	SCI162
Cat.158	SCI48
Cat.159	SCI120
Cat.160	SCI32
Cat.161	SCI130
Cat.162	SCI2
Cat.163	SCI28
Cat.164	SCI37
Cat.165	SCI38
Cat.166	SCI39
Cat.167	SCI275
Cat.168	SCI270
Cat.169	SCI49
Cat.170	MSS43
Cat.171	MSS736
Cat.172	MSS757
Cat.173	MSS718
Cat.174	MTW1311
Cat.175	MTW1312
Cat.176	MTW411
Cat.177	MTW1457
Cat.178	MTW122
Cat.179	MTW120
Cat.180	MTW1452
Cat.181	MTW626
Cat.182	MTW1453
Cat.183	MTW123
Cat.184	MTW1456
Cat.185	MTW793
Cat.186	MTW1454
Cat.187	MTW950
Cat.188	MTW127
Cat.189	MTW121
Cat.190	MTW1451
Cat.191	MTW125
Cat.192	MTW1469
Cat.193	MTW126
Cat.194	MTW624
Cat.195	MTW1458
Cat.196	MTW1354
Cat.197	MTW1070
Cat.198	MTW1455
Cat.199	MTW1436
Cat.200	MTW688
Cat.201	MTW848
Cat.202	MTW124
Cat.203	MTW1074
Cat.204	POT1696.24
Cat.205	POT1696.25
Cat.206	POT1696.1
Cat.207	POT1001
Cat.208	POT1000
Cat.209	POT376
Cat.210	GLS569
Cat.211	GLS553
Cat.212	GLS137
Cat.213	GLS517
Cat.214	MXD286
Cat.215	MXD17
Cat.216	MXD97
Cat.217	MXD20
Cat.218	MXD246
Cat.219	SCI131
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Cat.224	SCI358
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Cat.228	SCI265
Cat.229	SCI360
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Cat.231	SCI318
Cat.232	SCI352
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Cat.235	SCI319
Cat.236	SCI320
Cat.237	SCI321
Cat.238	SCI363
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Cat.240	SCI381
Cat.241	SCI382
Cat.242	SCI383
Cat.243	SCI97
Cat.244	SCI384
Cat.245	SCI385
Cat.246	SCI77
Cat.247	SCI317
Cat.248	SCI353
Cat.249	SCI103
Cat.250	SCI104
Cat.251	SCI355
Cat.252	SCI79
Cat.253	SCI81
Cat.254	SCI357
Cat.255	SCI387
Cat.256	SCI386
Cat.257	SCI82
Cat.258	SCI83
Cat.259	SCI85
Cat.260	SCI361
Cat.261	SCI93
Cat.262	SCI88
Cat.263	SCI86
Cat.264	SCI388
Cat.265	SCI87
Cat.266	SCI281
Cat.267	SCI78
Cat.268	SCI389
Cat.269	SCI323
Cat.270	SCI390
Cat.271	SCI96
Cat.272	SCI167
Cat.273	SCI80
Cat.274	SCI91
Cat.275	SCI394
Cat.276	SCI95
Cat.277	SCI393
Cat.278	SCI391
Cat.279	SCI392
Cat.280	SCI395
Cat.281	SCI396
Cat.282	SCI397
Cat.283	SCI398
Cat.284	SCI399
Cat.285	SCI400
Cat.286	SCI401
Cat.287	SCI402
Cat.288	SCI89
Cat.289	SCI403
Cat.290	SCI404
Cat.291	SCI405
Cat.292	SCI406
Cat.293	SCI407
Cat.294	SCI408
Cat.295	SCI409
Cat.296	SCI410
Cat.297	SCI411
Cat.298	SCI412
Cat.299	SCI413
Cat.300	SCI414
Cat.301	SCI415
Cat.302	SCI416
Cat.303	SCI370
Cat.304	SCI368
Cat.305	SCI371
Cat.306	SCI369
Cat.307	SCI380
Cat.308	SCI379
Cat.309	SCI378
Cat.310	SCI373
Cat.311	SCI372
Cat.312	SCI366
Cat.313	SCI340
Cat.314	SCI331
Cat.315	SCI335
Cat.316	SCI423
Cat.317	SCI424
Cat.318	SCI425
Cat.319	SCI377
Cat.320	SCI174
Cat.321	SCI108
Cat.322	SCI417
Cat.323	SCI418
Cat.324	SCI419
Cat.325	SCI420
Cat.326	SCI421
Cat.327	SCI422
Cat.328	SCI347
Cat.329	SCI99
Cat.330	SCI94
Cat.331	SCI365
Cat.332	SCI427
Cat.333	SCI324
Cat.334	SCI325
Cat.335	SCI274
Cat.336	SCI327
Cat.337	SCI326
Cat.338	SCI90
Cat.339	SCI328
Cat.340	SCI329
Cat.341	SCI330
Cat.342	SCI92
Cat.343	SCI364
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Cat.346	SCI124
Cat.347	SCI147
Cat.348	SCI257
Cat.349	SCI121
Cat.350	SCI119
Cat.351	SCI254
Cat.352	SCI138
Cat.353	SCI105
Cat.354	SCI116
Cat.355	SCI75
Cat.356	SCI72
Cat.357	SCI142
Cat.358	SCI141
Cat.359	SCI55
Cat.360	SCI56
Cat.361	SCI157
Cat.362	SCI140
Cat.363	SCI165
Cat.364	SCI126
Cat.365	SCI276A
Cat.366	SCI276B
Cat.367	SCI276C
Cat.368	SCI276D
Cat.369	SCI276E
Cat.370	SCI276F
Cat.371	SCI143
Cat.372	SCI154
Cat.373	SCI64
Cat.374	SCI259
Cat.375	SCI59
Cat.376	SCI60
Cat.377	SCI26
Cat.378	SCI63
Cat.379	SCI106
Cat.380	LAQ169
Cat.381	SCI426
Cat.382	SCI284
Cat.383	SCI14
Cat.384	SCI8
Cat.385	SCI15
Cat.386	SCI7
Cat.387	SCI164

Concordance by accession number

GLS137	Cat.212
GLS199	Cat.13
GLS252.1–6	Cat.16
GLS254	Cat.15
GLS324	Cat.14
GLS374	Cat.17
GLS375	Cat.18
GLS376	Cat.19
GLS454	Cat.12
GLS517	Cat.213
GLS553	Cat.211
GLS569	Cat.210
LAQ169	Cat.380
LAQ477	Cat.48
MSS43	Cat.170
MSS233	Cat.7
MSS243	Cat.21
MSS300	Cat.22
MSS329	Cat.6
MSS358	Cat.118
MSS375	Cat.116
MSS387	Cat.2
MSS412	Cat.106
MSS454.1–2	Cat.3
MSS499	Cat.1
MSS556	Cat.20
MSS568	Cat.11
MSS714	Cat.23
MSS718	Cat.173
MSS723	Cat.51
MSS734	Cat.46
MSS735	Cat.47
MSS736	Cat.171
MSS755	Cat.44
MSS756	Cat.45
MSS757	Cat.172
MSS759	Cat.43
MSS760.1–2	Cat.9
MSS776	Cat.8
MSS852.1–2	Cat.5
MSS873	Cat.4
MSS970	Cat.87
MSS973	Cat.10
MSS975	Cat.117
MTW120	Cat.179
MTW121	Cat.189
MTW122	Cat.178
MTW123	Cat.183
MTW124	Cat.202
MTW125	Cat.191
MTW126	Cat.193
MTW127	Cat.188
MTW188	Cat.27
MTW189	Cat.26
MTW190	Cat.33
MTW191	Cat.31
MTW192	Cat.30
MTW217	Cat.38
MTW265	Cat.37
MTW267	Cat.36
MTW320	Cat.61
MTW411	Cat.176
MTW526	Cat.28
MTW621	Cat.24
MTW624	Cat.194
MTW626	Cat.181
MTW688	Cat.200
MTW691	Cat.34
MTW793	Cat.185
MTW815	Cat.76
MTW825	Cat.120
MTW848	Cat.201
MTW850	Cat.344
MTW851	Cat.53
MTW897	Cat.52
MTW950	Cat.187
MTW1070	Cat.197
MTW1074	Cat.203
MTW1311	Cat.174
MTW1312	Cat.175
MTW1346	Cat.54
MTW1354	Cat.196
MTW1378	Cat.29
MTW1436	Cat.199
MTW1443	Cat.25
MTW1444	Cat.32
MTW1451	Cat.190
MTW1452	Cat.180
MTW1453	Cat.182
MTW1454	Cat.186
MTW1455	Cat.198
MTW1456	Cat.184
MTW1457	Cat.177
MTW1458	Cat.195
MTW1469	Cat.192
MXD17	Cat.215
MXD20	Cat.217
MXD97	Cat.216
MXD172	Cat.109
MXD205	Cat.110
MXD246	Cat.218
MXD286	Cat.214
POT253A	Cat.42
POT253B	Cat.41
POT376	Cat.209
POT1000	Cat.208
POT1001	Cat.207
POT1271	Cat.40
POT1433	Cat.39
POT1696.1	Cat.206
POT1696.24	Cat.204
POT1696.25	Cat.205
SCI1	Cat.122
SCI2	Cat.162
SCI3	Cat.125
SCI4	Cat.138
SCI5	Cat.131
SCI6	Cat.150
SCI7	Cat.386
SCI8	Cat.384
SCI10	Cat.132
SCI11	Cat.127
SCI12	Cat.129
SCI13	Cat.128
SCI14	Cat.383
SCI15	Cat.385
SCI16	Cat.55
SCI17	Cat.56
SCI18	Cat.57
SCI19	Cat.148
SCI21	Cat.123
SCI22	Cat.119
SCI26	Cat.377
SCI27	Cat.154
SCI28	Cat.163
SCI29	Cat.136
SCI30	Cat.152
SCI31	Cat.139
SCI32	Cat.160
SCI33	Cat.108
SCI35	Cat.147
SCI36	Cat.126
SCI37	Cat.164
SCI38	Cat.165
SCI39	Cat.166
SCI40	Cat.156
SCI41	Cat.155
SCI42	Cat.135
SCI43	Cat.114
SCI44	Cat.141
SCI45	Cat.134
SCI47	Cat.142
SCI48	Cat.158
SCI49	Cat.169
SCI50	Cat.153
SCI51	Cat.113
SCI53	Cat.133
SCI55	Cat.359
SCI56	Cat.360
SCI59	Cat.375
SCI60	Cat.376
SCI63	Cat.378
SCI64	Cat.373
SCI72	Cat.356
SCI75	Cat.355
SCI76	Cat.222
SCI77	Cat.246
SCI78	Cat.267
SCI79	Cat.252
SCI80	Cat.273
SCI81	Cat.253
SCI82	Cat.257
SCI83	Cat.258
SCI85	Cat.259
SCI86	Cat.263
SCI87	Cat.265
SCI88	Cat.262
SCI89	Cat.288
SCI90	Cat.338
SCI91	Cat.274
SCI92	Cat.342
SCI93	Cat.261
SCI94	Cat.330
SCI95	Cat.276
SCI96	Cat.271
SCI97	Cat.243
SCI99	Cat.329
SCI100	Cat.230
SCI103	Cat.249
SCI104	Cat.250
SCI105	Cat.353
SCI106	Cat.379
SCI108	Cat.321
SCI113	Cat.345
SCI116	Cat.354
SCI119	Cat.350
SCI120	Cat.159
SCI121	Cat.349
SCI124	Cat.346
SCI126	Cat.364
SCI130	Cat.161
SCI131	Cat.219
SCI135A–M	Cat.107
SCI138	Cat.352
SCI140	Cat.362
SCI141	Cat.358
SCI142	Cat.357
SCI143	Cat.371
SCI147	Cat.347
SCI153	Cat.137
SCI154	Cat.372
SCI155	Cat.151
SCI157	Cat.361
SCI158	Cat.124
SCI159	Cat.145
SCI160	Cat.146
SCI161	Cat.144
SCI162	Cat.157
SCI164	Cat.387
SCI165	Cat.363
SCI167	Cat.272
SCI174	Cat.320
SCI254	Cat.351
SCI257	Cat.348
SCI259	Cat.374
SCI261	Cat.115
SCI262	Cat.121
SCI265	Cat.228
SCI266	Cat.112
SCI270	Cat.168
SCI271	Cat.149
SCI274	Cat.335
SCI275	Cat.167
SCI276A	Cat.365
SCI276B	Cat.366
SCI276C	Cat.367
SCI276D	Cat.368
SCI276E	Cat.369
SCI276F	Cat.370
SCI278	Cat.233
SCI281	Cat.266
SCI282	Cat.143
SCI283	Cat.130
SCI284	Cat.382
SCI285	Cat.140
SCI317	Cat.247
SCI318	Cat.231
SCI319	Cat.235
SCI320	Cat.236
SCI321	Cat.237
SCI322	Cat.220
SCI323	Cat.269
SCI324	Cat.333
SCI325	Cat.334
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SCI327	Cat.336
SCI328	Cat.339
SCI329	Cat.340
SCI330	Cat.341
SCI331	Cat.314
SCI335	Cat.315
SCI340	Cat.313
SCI347	Cat.328
SCI348	Cat.223
SCI349	Cat.221
SCI350	Cat.226
SCI351	Cat.227
SCI352	Cat.232
SCI353	Cat.248
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SCI361	Cat.260
SCI362	Cat.239
SCI363	Cat.238
SCI364	Cat.343
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SCI366	Cat.312
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SCI369	Cat.306
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SCI371	Cat.305
SCI372	Cat.311
SCI373	Cat.310
SCI377	Cat.319
SCI378	Cat.309
SCI379	Cat.308
SCI380	Cat.307
SCI381	Cat.240
SCI382	Cat.241
SCI383	Cat.242
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SCI386	Cat.256
SCI387	Cat.255
SCI388	Cat.264
SCI389	Cat.268
SCI390	Cat.270
SCI391	Cat.278
SCI392	Cat.279
SCI393	Cat.277
SCI394	Cat.275
SCI395	Cat.280
SCI396	Cat.281
SCI397	Cat.282
SCI398	Cat.283
SCI399	Cat.284
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SCI403	Cat.289
SCI404	Cat.290
SCI405	Cat.291
SCI406	Cat.292
SCI407	Cat.293
SCI408	Cat.294
SCI409	Cat.295
SCI410	Cat.296
SCI411	Cat.297
SCI412	Cat.298
SCI413	Cat.299
SCI414	Cat.300
SCI415	Cat.301
SCI416	Cat.302
SCI417	Cat.322
SCI418	Cat.323
SCI419	Cat.324
SCI420	Cat.325
SCI421	Cat.326
SCI422	Cat.327
SCI423	Cat.316
SCI424	Cat.317
SCI425	Cat.318
SCI426	Cat.381
SCI427	Cat.332
TLS3	Cat.81
TLS4	Cat.78
TLS5	Cat.62
TLS6	Cat.35
TLS7	Cat.58
TLS9	Cat.84
TLS10	Cat.83
TLS11	Cat.82
TLS12	Cat.98
TLS15	Cat.59
TLS16	Cat.60
TLS18	Cat.97
TLS20	Cat.96
TLS21	Cat.94
TLS22	Cat.95
TLS24	Cat.103
TLS26A	Cat.99
TLS26B	Cat.100
TLS27A	Cat.101
TLS27B	Cat.102
TLS28A	Cat.88
TLS29	Cat.90
TLS30	Cat.92
TLS31	Cat.93
TLS32	Cat.89
TLS33	Cat.91
TLS45	Cat.104
TLS49	Cat.63
TLS134	Cat.111
TLS1860	Cat.85
TLS1920	Cat.67
TLS1956	Cat.66
TLS1957	Cat.80
TLS1958	Cat.64
TLS1959	Cat.65
TLS2466	Cat.72
TLS2609	Cat.77
TLS2610	Cat.68
TLS2611	Cat.73
TLS2613	Cat.75
TLS2614	Cat.71
TLS2615	Cat.70
TLS2616	Cat.74
TLS2622	Cat.69
TLS2624	Cat.79
TLS2707	Cat.86
TXT77	Cat.49
TXT87	Cat.50
TXT225	Cat.105

Documentation

Cat.6

Folio 112b:

تمت المقالة السابعة من الكتاب المنصوري ... و ذلك بتاريخ [...] ربيع الاول من سنة سبعين و ستما[ئة]

The seventh discourse of the *Kitāb al-Manṣūrī* ... has been completed, and that [occurred] on [...] Rabiʿ I of the year 670.

Cat.7

Folio 154a:

تمام شد كتاب اخلاق ناصرى ... في اواخر ربيع الاول من شهور سنة ثمان و ستين [و] ستماية على يد مسعود بن احمد الحافظ.

The *Kitāb Akhlāq-i Nāṣirī* was completed ... in the last ten days of Rabiʿ I of the year 668, by Masʿud ibn Ahmad al-Hafiz.

Cat.10

Folio 195a:

تمت الكتاب الموسوم باختيارات بديعي ... في تاريخ پنجم شهر ذى الحجة الحرام سنة ثمان و خمسين بعد الالف سنه ١٠٥٨.

The book called *Ikhtiyārāt-i Badīʿī* ... was completed on 5 Dhu'l Hijjah 1058.

حرره الفقير الحقير حسن بيك ابن مرحوم حاجي لطف اللّه يزدي مشهوربه قصاب.

Copied by the one needy [for God's mercy] the wretched Hasan Beg son of the late Hajji Lutf Allah Yazdi, known as *Qaṣṣāb* ('Butcher').

Cat.11

Folio 2a:

برسم خزانة مولانا السلطان سليمان خان بن السلطان سليم خان اعز اللّه دولتهم على مر العصور و الازمان.

For the library of our Lord the Sultan Süleyman Khan, son of the Sultan Selim Khan – may God exalt their dynasty during the passing of the ages and eras!

Folio 74b:

كتبه العبد الفقير عبد الرحمن بن موهوب الدمشقي المتطبب بتاريخ الحادي والعشرين من شهور [sic] شوال سنة ستة و عشرين و تسعماية ... و ذلك لخدمة خزانة السلطان سليمان خان بن السلطان سليم خان خلد اللّه ملكهم.

Written by the poor servant ʿAbd al-Rahman ibn Mawhub al-Dimashqi al-Mutatabbib ('the Physician') on 21 Shawwal 926 ..., for the library of Sultan Süleyman Khan, son of Sultan Selim Khan – may God make their dominion eternal!

Cat.20

Folios 220a–220b:

نجز ... كتاب شمس المعارف الكبرى ... في ضحى يوم الخميس رابع ربيع النبوي الانور سنة ١٢٨٥ ... [220b] علي يد ... محمد بن احمد بناني المراكشى المنشأ و الدار الفاسي الاصل النفزي النجار ... كتبه للمولى الشريف ... مولانا حسن بن امير المؤمنين مولانا محمد بن امير المؤمنين مولانا عبد الرحمان بن امير المؤمنين مولانا هشام ابن امير المؤمنين مولانا محمد بن امير المؤمنين مولانا عبد الله ابن امير المؤمنين مولانا اسماعيل ....

The *Kitāb shams al-maʿārif al-kubrā* ... was completed in the forenoon of Thursday, 4 Rabiʿ [II ?] 1285 ... by ... Muhammad ibn Ahmad Banani al-Marrakushi by birth and residence, al-Fasi by family origin, al-Nafzi by descent ... He wrote it for the noble lord ... Mawlana Hasan, son of the Commander of the Faithful Mawlana Muhammad, son of the Commander of the Faithful Mawlana ʿAbd al-Rahman, son of the Commander of the Faithful Mawlana Hisham, son of the Commander of the Faithful Mawlana Muhammad, son of the Commander of the Faithful Mawlana ʿAbd Allah, son of the Commander of the Faithful Mawlana Ismaʿil ... .

Cat.22

Folio 119a:

فرغ من كتابته عبد المحسن ابن احمد بن احمد الكتبي البغدادي ... يوم السبت ١٦ شهر ذي القعدة الحرام سنة ٨٢٨ ....

ʿAbd al-Muhsin ibn Ahmad ibn Ahmad al-Kutubi al-Baghdadi ... finished copying [this book], on Saturday, 16 Dhu'l-Qaʿdah 828 ... .

Cat.25

هذه الطاسة المباركة للسموم كلها وقد جمع فيها منافع مجربة و هي للسعة الحية والعقرب والحما و للمطلقة والفرس المغلة والكاب الكلب وللمغص والقولنج وللشقيقة والضربان والحما الكبد والطحال وللقوة ولرمي الدم ولوجع القلب وللعين والنظرة وللرمد والنزلة ولرياح الشوكة وللارواح ولحل المعقود ولجميع العلل والآفات ويسقي فيها ماء او زيت او لبن فانه يبري باذن اللّه تعالى. رُصِدَت و الشمس في اسد ونقِشَت برسم السلطان الملك العادل محمود بن زنكي في سنة خمسة وستين وخمسماية.

This blessed cup is for every poison. In it have been gathered proven uses, and these are for the sting of serpent, scorpion and fever, for a woman in labour, the abdominal pain of a horse caused by eating earth, and the [bites of] a rabid dog, for abdominal pain and colic, for migraine and throbbing pain, for hepatic and splenic fever, for [increasing] strength, for [stopping] haemorrhage, for chest pain, for the eye and vision, for ophthalmia and catarrh, for *riyāḥ al-shawkah*, for [driving out] spirits, for releasing the bewitched, and for all diseases and afflictions. [If] one drinks water or oil or milk in it, then they will be cured, by the help of God Almighty. It was prepared [while] the sun was in Leo and engraved for the Sultan al-Malik al-ʿAdil Mahmud ibn Zangi in the year 565.

Cat.26

هذه الطاسة المباركة تقاوم السموم كلها وقد جمع فيها منافع مجربة وفيها آيات الشفا من كتاب اللّه العزيز وهي للسعة الحية والعقرب والحما وللمطلقة والمغلة وللكلب الكلب وللمغص والقولنج وللشقيقة والضربان والحما الكبد والطحال وللقوة ولرمي الدم ولوجع القلب ولوجع الضرس وللنزلة وللعين والنظرة ولجميع العلل والآفات ويسقي فيها الملسوع او رسوله فيـ[ـها] زيت او ماء او لبن فانه يبري باذن اللّه تعالى. برسم الامام المستعصم باللّه محمد الباقر والقمر في برج العقرب سنة اثنين و خمسمائة.

This blessed cup neutralizes all poisons. In it have been gathered proven uses, and in it are verses of healing from the Book of God the Powerful. It is [useful] for the sting of serpent, scorpion and fever, for a woman in labour and increasing milk [of a nursing mother], for the [bites of] a rabid dog, for abdominal pain and colic, for migraine and throbbing pain, for hepatic and splenic fever, for [increasing] strength, for [stopping] haemorrhage, for chest pain, for toothache, for catarrah, for the eye and vision, and for all diseases and afflictions. [If] the afflicted person or their agent drinks oil or water or milk in [it], then they will be cured, by the help of God Almighty. By order of the Imam al-Mustaʿsim bi-Allah Muhammad al-Baqir while the moon was in the House of Scorpio [in the] year 502.

Cat.30

on underside of boss:

يا صاحب الزمان سنة ١٠٤٤.

O Master of the Age! Year 1044.

Cat.34

on the flat surface of the base, inside the footring:

عمل علي رضا سركار.
دام اقباله
هفت جوش
قيمت دوصدوپنجاه روپيه

Made by ʿAli Rida Sarkar.
May his good fortune endure!
Haft-jūsh ('Sevenfold boiling').
Price 250 rupees

Cat.35

in a cartouche on the base:

ماه رمضان المبارك سنه ١٠١٤ هجرى
بروز جمعه

[In] the blessed month of Ramadan AH 1014, on a Friday.

Cat. 43

at the base of the top disc:

كاتبي الحاج موسى.

Written by al-Hajj Musa

at the top of the central disc:

ساعت قمرده ابتدا اولندي وساعت زهره ده تمام
اولندي سنه ١١٢٤ في شهر ربيع الاول يوم
الاثنين.

It was begun at the hour of the Moon and was finished at the hour of Venus, in the year 1124, in the month of Rabiʿ I, on a Monday.

in the top left-hand square in the grid of squares on the right:

صاحب هذا الطلسم القران العظيم الكريم
وحليه شريف مصطفى ابن ابراهيم.

The owner of this talisman of the Mighty [and] Noble Qur'an and of the Noble Description is Mustafa ibn Ibrahim.

Cat. 44

in the central cartouche in the border beneath the main panel:

جهة سلامتي وجود مبارك حضرت مسطاب
عمدة الفضلاء الكرام آقاي آقا رضا ئى[رضا بن ؟]
هاجر فى شهر رجب المجرب ١٣٣٧
شمس الذاكرين.

For the well-being of the blessed person of his gracious lordship, the support of the noble men of excellence, the noble prince (Aqa) Riza'i travelling [*or* Aqa Riza ibn Hajir] in the month of Rajab 1337. [Given by (?)] Shams al-Dhakirin.

Cat. 118

Folio 266a:

تم على يد احقر العباد ابن مير عبدالله مير جعفر
الحسينى التبريزى في ١٠٧٠.

It was completed by the most contemptible of slaves, Ibn Mir ʿAbd Allah Mir Jaʿfar al-Husayni al-Tabrizi in 1070.

Folio 146a, in margin:

قوبل مع نسخة التى قوبل مع اصل نسخة
المصنف.

It was collated with a copy that was collated with the original copy of the author.

Cat. 119

across the centre of the two lower quadrants:

صنعه محمد بن خضر الاصطرلابي في سنة خضر.

Made by Muhammad ibn Khidr al-Asturlabi in the year *kh-ḍ-r* ('697').

Cat. 120

on the central palmette:

صنعه شاكر بن احمد.

Made by Shakir ibn Ahmad.

Cat. 122

in profile along the inside of the outer rim:

صنعه محمد بن ابي بكر بن محمد راشدي.

Made by Muhammad ibn Abi Bakr ibn Muhammad Rashidi.

Cat. 123

in the northern hemisphere, below the pole star:

صنعه محمد بن محمود
بن علي الطبري.

The work of Muhammad ibn Mahmud ibn ʿAli al-Tabari.

in the southern hemisphere:

رُسِمَت هذه الكواكب من كتاب الصور لابي
الحسين الصوفي بعد الزيادة على اطوالها لزماننا
٥ درجة وتصحيح ماجرى فيه سهوا وتصحيف
على المترحمين وذلك في سنة ٦٨٤ وكتـ[...]
محمد

These stars were drawn from *Kitāb al-Ṣuwar* by Abu'l-Husayn al-Sufi, after increasing their longitudes by 5 degrees to correspond to our time; the correction of whatever errors may have occurred in it and of any orthographical mistakes is left to those who are compassionate. This [occurred] in the year 684. Written by Muhammad ibn Mahmud al-Asturlabi.

Cat. 126

on the back, in the centre of the upper right quadrant:

[...] اضعف العباد محمد مقيم بن عيسى بن
الهداد اسطرلابي همايوني لاهوري تحريرً[ا] في
شهر [...]ن سنه ١٠٣ هجري.

[Made by] the weakest of the servants, Muhammad Muqim ibn ʿIsa ibn Allahdad Asturlabi Humayuni Lahuri, written in the month of [...] in AH 103[?].

Cat. 127

on the back, within the shadow square:

عمل اقل العباد ضياؤ الدين محمد ابن قايم محمد
ابن ملا عيسى ابن شيخ الهداد اسطرلابي همايوني
لاهوري في سنه ١٠٧١ هجري.

The work of the least of servants Diya' al-Din Muhammad ibn Qa'im Muhammad ibn Mulla ʿIsa ibn Shaykh Allahdad Asturlabi Humayuni Lahuri in AH 1071.

Cat. 128

on the back, around the shadow square:

صنـ[ـعـ]ـه قليل [sic] العباد حامد ابن محمد مقيم
ابن عيسى ابن الهداد اسطرلابي لاهوري همايوني
في تاريخ ٢ شهر محرم الحرام في سنه ١٠٦٨ هجريه.

Made by the least of servants Hamid ibn Muhammad Muqim ibn ʿIsa ibn Allahdad Asturlabi Lahuri Humayuni on 2 Muharram AH 1068.

Cat. 129

on the front, within the kursi:

الله اكبر! سنه ١٠٣١ هجري.

God is Most Great! AH 1031.

on the back, within the kursi:

سنه ١٧ جلوس جهانكيري.

Year 17 from the accession of Jahangir.

Cat. 130

on the back, across the centre of the two lower quadrants:

عمل القل[sic] العباد ضياؤ الدين محمد بن قايم
محمد بن ملا عيسى / ابن شيخ الهداد [ا]صطرلابي
همايوني لاهوري.

The work of the least of servants Diya' al-Din Muhammad ibn Qa'im Muhammad ibn Mulla ʿIsa ibn Shaykh Allahdad Asturlabi Humayuni Lahuri.

Cat. 131

on the back, within the scale of the cotangent on the rim of the lower right quadrant:

عمل اقل العباد حامد ابن محمد مقيم ابن عيسى
ابن الله داد اسطرلابي لاهوري همايوني تحريرا في
التاريخ ٢١ شهر محرم الحرام في سنه ١٠٩٨.

The work of the least of the servants Hamid ibn Muhammad Muqim ibn ʿIsa ibn Allahdad Asturlabi Lahuri Humayuni, written on 21 Muharram 1098.

on the back, in the centre of the quadrant:

مالك قادر داد خان موهندوس[sic] سنه
.١٨٧٦

[Its] owner [is] Qadirdad Khan Muhandis, AH 1186.

Cat. 134

below the constellation Piscis Austrinus:

عمل محمد صالح تتوى سنه ١٠٧٤.

The work of Muhammad Salih Tatawi, year 1074.

Cat. 138

below the constellation Piscis Austrinus:

این کره منقول ست از کرهٔ اکبرشاه مهندس
جهان آبادی که در/ سنه ۱۲۶۰ هـ بحضور
خاقان زمان ابو الظفر مصلح الدین ثریاجاه/ محمد
امجد علی شاه پادشاه نذر گذرانیده بود/
فقیر حقیرمحمد نعیم الدین مراد آبادی غفر له در
سنه ۱۲۵۷ هـ/
این نقل را مکمل کرد و بفضله تعالی بهتر و کامل
تر از صل/ ساخته شد له الحمد و له المنه.

This globe was copied after the globe of Akbar Shah Muhandis Jahanabadi, [and it was] presented to the Emperor of the Age, the Father of Victory, the Reformer of the Faith, the Exalted as the Pleiades, Muhammad Amjad ʿAli Shah, Padshah in AH 1260. The poor, base Muhammad Naʿim al-Din Muradabadi – May God forgive him [his sins] – completed this copy in AH 1257, and by the grace of [God] – May He be exalted! – it was made in a better and more perfect fashion than the original – Praise and thanks be to Him!

(An attempt has been made to change the dates from 1260 and 1257 to 1060 and 1157 respectively.)

Cat. 140

on one face of the zenith ring:

این کره فلکي جوتشی [sic] دهر مچند.ههة

This celestial globe [belongs to] Jotishi [the astrologer/astronomer] Daharamchand.

Cat. 144

on the back, within a cartouche set across the meridian in the lower two quadrants:

نمقه محمد مهدي اليزدي.

Decorated by Muhammad Mahdi al-Yazdi.

on the rete, on the Capricorn band:

از تیز عقل جستم تاریخ آن بکفت/
آینهء سکندر و جام جهان نماست/

I acquired the date of it from a man of sharp intellect; he said, 'It is the mirror of Alexander and the cup that shows the Universe.'

Cat. 147

on the back, at the base:

عبد الأ/ ئمه ٨.

ʿAbd al-Aʾimmah, 8.

Cat. 148

seal impression, at the base of the box:

خادم العلم محمد خان ١١٩١.

The servant of science, Muhammad Khan, 1191.

Cat. 149

on the back, at the base:

عمل حاجي علي بن صادق.

The work of Hajji ʿAli ibn Sadiq.

Cat. 150

on the front, within the kursi:

حسب الامر قدر قدر بندکان سریا [sic] مکان
محمود میرزا قاجار بانجام رسید.

It was completed at the command, which has the power of Destiny, of one equal in rank with the Pleiades, Mahmud Mirza Qajar.

on the back, within the kursi:

هو الله تعالی! حسب الامر قدر قدر شاهزاده
اعظم در قصبه نهاوند بهشت مانند این بنده
درکاه محمد اکبر افشار بانجام رسانید.

He is God! May He be exalted! It was completed at the command, which has the power of Destiny, of the mighty Prince, in the town of Nahavand, which resembles Paradise, by this servant of the Court, Muhammad Akbar Afshar.

on the back, within a cartouche below the shadow square:

صنعه محمد اكبر ١٢٣٤.

Made by Muhammad Akbar, 1234.

Cat. 151

in the southern hemisphere, below the Tropic of Capricorn:

بعون اللّه الصانع الارض والسماء. قد فرغ من
اتمام/ صناعة هذا تراب اقدام الضعفاء محمد
شريف/ بن محمد رضا يوم الاربعا من شهر
جمادى الاولى/ غريب من هجرة خاتم الانبيا.
١٢١٢

With the aid of God, Creator of Heaven and Earth, the dust of the feet of the most humble, Muhammad Sharif ibn Muhammad Rida completed the production of this [globe] on Wednesday in the month of Jumada I *gharib* (1212) since the Migration of the Seal of the Prophets.

Cat. 152

on the back, in a semicircular band across the centre of the horary diagram:

صنعه محمد بن احمد البطوطي لطف الله به في
سنة شقيح.

Made by Muhammad ibn Ahmad al-Battuti – God's favour be upon him! – in the year *shaqīḥ* [transcribed as eastern Arabic].

(ش 1000, ق 100, ي 10, ح 8. This is according to the Maghribi system of *abjad*. In the rest of the Islamic world it would give 300 + 100 + 10 + 8 = 418. On the *abjad* letter-numerals, see Part One, p. 199.) (The letter ف has been read as *fāʾ* in the catalogue entry; it is a Maghribi *qāf*.)

Cat. 155

on the back:

عام 1344 في عصر الامير احمد بن ابي بكر
الزناتي. فاس.

Year 1344, in the time of the *amir* Ahmad ibn ʿAbi Bakr al-Zanati. Fez.

Cat. 156

on one side:

حرره حافظ حسن الحلمي بكبرزاده ١٢٥٦.

Written by Hafiz Hasan al-Hilmî, known as Gebirzade, 1256.

on the other side:

حرره الحافظ الحسن الاوفي بكبرزاده ... سنه
١٢٥٦ قمري.

Written by al-Hafiz al-Hasan al-ʿUfi [known] as Gebirzade ... year 1256 lunar.

Cat. 157

within a cartouche on one side:

الحاج سيد سليمان رشدي سكودي ١٣٠٣.

Al-Hajj Sayyid Sulayman Rushdi Sukudi [Süleyman Ruşdî Söğüdî], 1303.

on the other side, next to the brass bush for the plumb line:

سكودي

Sukudi [Söğüdî].

on the same side, at the end of the scale degrees on the limb:

... سنه١٣٠٣.

Year 1303.

Cat. 158
on one side, near the apex of the quadrant:

عثمان بوسنوي.

'Uthman Busnawi [Osman Bosnevî].

Cat. 159
on one side, at the apex of the unequal hour diagram:

رسمه ابراهيم نسيمي.

Drawn by İbrahim Nesimi.

Cat. 160
on one side, below the scale of degrees:

رسمه عبد المحسن ابن المرحوم صالح افندي المرادي عفى عنه في ١٠ س جماد اخر[...] سنه ١٢٩٧.

Engraved by 'Abd al-Muhsin, son of the late Salih Efendi al-Muradi – May He pardon him! – on 10 Jumada II 1297.

Cat. 161
on the radius:

طوپ فابريقسي نومرو ٣٠٧.

Cannon Foundry, no. 307.

Cat. 162
on the back:

صنعه الاقل عبد الائمه.

Made by the least [of servants], 'Abd al-A'immah.

Cat. 163
below the quadrant of degrees in one corner:

صنعه فتحعلي.

Fath 'Ali made it.

Cat. 167
in the border of the fly card:

رسمه احمد موقت جامع عثمانيه سنه ١٢٢٣.

Drawn by Ahmad, time-keeper of the Osmaniye Mosque, year 1223.

Cat. 168
on the base of the brass semicircle:

عمل علي الموقت ابو الفتح/ سلطان محمد سنه ١١٦١.

The work of Ali, time-keeper [at the mosque of] Abu'l-Fath Sultan Mehmed, year 1161.

Cat. 169
below the compass:

رسمه الفقير [...] يم خان.

Drawn by the poor ... im Khan.

on the same side, at the end of the scale of degrees on the limb:

١٩ ذي القعده سنه ١٢٧٩.

19 Dhu'l-Qa'dah 1279.

Cat. 170

كتبه الفقير السيد حسن الحلمي ١٠١٢.

Written by the poor al-Sayyid Hasan al-Hilmi, 1012

Cat. 171
in the gold roundel above the 'unwan:

حرره اضعف الكتاب محمد المعروف بنائلي يازجي [...] ١٢٢٠.

Written by the feeblest of scribes Muhammad known as Na'ili Yaziji [...] 1220.

at the end:

كتبه محمد المعروف بنائلي ١٢٢٠.

Written by Muhammad, known as Na'ili.

Cat. 172

كتبه السيد محمد المعروف بحكمتي سنه ١٢٧[...].

Written by al-Sayyid Muhammad, known as Hikmati, year 127[...].

Cat. 215
in the segmented cartouches:

عز الدولة والدين الملك الامرا/ الامير خراسان سه هدارغازي الحسين بن خرميل.

'Izz al-Dawlah wa'l-Din, *Malik al-Umara'*, the Amir of Khurasan, the *Sipahdar*, the *Ghazi*, al-Husayn ibn Kharmil.

Cat. 216
on the upper part of design A:

عمل محمد بن يوسف

The work of Muhammad ibn Yusuf.

in the border of design B:

عمل محمد

The work of Muhammad.

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